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SPONDYLOTHERAPY

PHYSIO-THERAPY OF THE SPINE BASED ON A STUDY OF CLINICAL PHYSIOLOGY

BY

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THIRD EDITION, ENLARGED

THE PATHOLOGY OF SPONDYLOLOGY IS FOUNDED ON CLINICAL PHYSIOLOGY AND ITS METHODS EMBRACE THE THERAPEUTICS OF THE REFLEXES

PHILOPOLIS PRESS

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1912

TO THE MEMBERS
OF THE FACULTY OF MEDICINE, PARIS,
IN RECOGNITION OF THEIR DISTINGUISHED SERVICES
IN THE ADVANCEMENT OF MEDICINE AND
FOR MANY ACTS OF COURTESY
THIS BOOK IS DEDICATED
BY THE AUTHOR

Preface to the First Edition

THE subject of spinal therapeutics has received less attention from the medical profession than it deserves. Even the laity know that cold applied to the back of the neck may arrest hemorrhage from the nose, and that heat applied to the small of the back may hasten menstruation. The profound and far-reaching physiologic truths which underlie these simple phenomena have either been ignored or only given inconsiderate attention.

Others, less scientific but more astute, have determined empirically that manipulation of the spine does sometimes cure conditions that have failed of cure in the hands of experienced physicians. So it has come to pass that schools of practice exploiting spinal manipulation as a cure-all have arisen. Neither the fury of tongue nor the truculence of pen can gainsay the confidence which these systems of practice have inspired in the community.

The author was led to a deeper study of spinal therapeutics in investigating various visceral reflexes which bear his name. As the years passed on, he ascertained that a number of pathologic conditions could be more easily and certainly controlled by spondylotherapeutic means, than by the conventional measures.

Some physicians may consider the remedial methods discussed in this book to be unduly and unworthily simple, on the principle that what is obvious can hardly compete with what is obscure in the treatment of disease. The most mystifying phenomena rest upon the least complex causes; and the simpler a thing is, the harder it is to understand.

Anybody, however, who investigates the study of spinal therapeutics in earnest, will discover that the simplicity is only apparent. The successful practice of spondylotherapy requires knowledge, observation and experience of the highest kind, and is comparable to the best effort in any other department of scientific medicine. Indeed, one of the author's truest motives has been to lift this whole subject of spinal therapy out of the low state in which it blunders onward, hitting or missing as the case may be, and rescuing it from the lowly esteem which physicians as a class have thus felt for it. He has endeavored to put it in a place befitting its scientific importance, and to emphasize its great practical helpfulness in disease.

Preface to the First Edition

Any method of cure that is more or less new is inclined to be viewed critically by the formalist and traditionalist, and so it should be. The writer knows better than any one else can the incompleteness and imperfections of his work. It is really a pioneer effort and he only asks that it be judged as such. Indeed, the author hopes to receive many suggestions and if need be, corrections, and to profit by them.

One word concerning the cases cited in illustration of the methods which the author has described in various parts of the book. These may seem more or less incredible, the outcome of enthusiasm, bias, of some defect of the power of scientific observation, or of judgment. Yet the cases cited are not the most remarkable that the author has encountered in his practice. Some of these cases have been deliberately suppressed with a feeling that many readers are hardly prepared to appreciate or to credit the results which may be achieved by an earnest study and practice of spondylotherapy. To eschew a remedy because we cannot gauge its material properties may be an act worthy of the scientist, but the aim of the physician is to cure disease. In the presence of a sick man, two questions are to be answered: "What is the matter with him, and what will do him good?" Neither the pragmatical doctrinaire who accepts nothing but what is demonstrated morphologically, nor the representative of an exclusive system of practice, with his introspective reasoning, can aid therapeutics. The former forgets that the crucial test for the action of remedial measures is in their clinical application and that many of our most potent drugs have been inherited from the therapeutic acumen of our medical ancestors. "The diseases of which we know the least pathology are the diseases which we treat successfully." Cure, as conceived by the introspectionist, cannot merit the imprimatur of the scientist, and for this reason, the author has endeavored to justify his conclusions by demonstrable evidence.

ALBERT ABRAMS.

246 POWELL STREET,
SAN FRANCISCO, CAL.,
JANUARY, 1910.

Preface to the Third Edition

THE favorable reception accorded to the previous editions, has induced the author to undertake the enlargement of this work by the addition of seven chapters (xii—xviii) and fifty new illustrations.

When the first edition of this book was published, nearly two years ago, it was a pioneer effort and only the cognoscenti could correctly interpret its real significance, *viz.*, that spondylotherapy was suggested by the study of *human* physiology, on the principle that, "The proper study of mankind is man." After this manner, clinical physiology is made the basis of clinical pathology. To launch an innovation in medicine, with its surfeit of theories and theorists, is fraught with much risk to the innovator and the author anticipated the usual fate accorded to the originator, *viz.*, condemnation, discussion and possibly acceptance. Neither fear of difficulty, nor adverse criticism, deterred him from regarding scepticism as an argument against the truth of his observations.

It is indeed unfortunate that our medical journals have not yet attained that Utopian condition, when they are eager to give space to the protestations of an author, who feels that his work has been misinterpreted or unjustly criticised. For the latter reason, the author may be pardoned for utilizing the bulk of this preface in refuting some reviews of the previous edition. The review of "*The Journal of the American Medical Association*," is discussed on page 387. Occasionally, a reviewer has sat in the scorner's seat and hurled the cynic's ban. "There is a principle which is a bar against all information, which is proof against all argument and which cannot fail to keep a man in everlasting ignorance ; this principle is contempt prior to examination."

A reviewer asseverated that the book contained nothing that was particularly new. The latter conflicted with another reviewer who said, "*There are fifty pages scattered throughout the volume, any one of which could be torn out and be used as a starting point and an inspiration for most valuable research work. The possessor of this book has a rich mine of startlingly suggestive knowledge . . . . and to the man of study who strives to reach ever better and more fruitful*

methods of investigation and cure of disease, this book will be most welcome."

In another publication a prominent surgeon commented as follows: "*Probably the most startlingly radical stand ever taken within the ranks of the medical profession was that announced this very year by* DR. ALBERT ABRAMS, *of San Francisco, in his remarkable book, 'Spondylotherapy.'* "

An eminent French clinician, in commenting on "Spondylotherapy," says: "*Some of my results and those of my colleagues in Paris, by the methods of spondylotherapy are positively miracles.*"

Those "in authority"? who regard innovation from the viewpoint of heresy, recalls the *bon mot* by a witty compatriot of Talleyrand, who, in commenting on the conservatism of the latter said, if Talleyrand, had been present at the creation he would have exclaimed: "Good gracious! Chaos will be destroyed."

"He who dreads new remedies must abide old evils."

Yet another reviewer who questioned the right of a clinician to digress from traditional methods in the investigation of facts physiologic, must be answered. It is not now unusual for the laboratory-physiologist, to preside at the birth of his theory one day, and for the clinicist to officiate at its burial on the morrow. Pavloff observes, "The physician gives a more correct verdict concerning physiologic processes than the physiologist himself." Hughlings Jackson, was one of the greatest scientific neurologists, yet he never performed an experiment but formulated his conclusions in the wards of a hospital. Some of his enthusiastic proselytes have arrogated to the author the questionable honor of having created a new system of medical practice. No system can exclusively preempt the field of therapeutics, which is a composite practice founded on empiricism and the practical application of pharmacology and other sciences in the treatment of disease and the innovationist must create no discontinuity in the transition to new knowledge. As an emphatic protest to such an assumption, the author has incorporated many facts relating to the employment of drugs in the treatment of disease and refers to his monograph, "Diagnostic-Therapeutics." When the author employed the neologism, spondylotherapy (G. *Spondylos*, vertebra + *therapeia*, treatment), he advocated no exclusive methods in spinal therapeutics, but employed all the resources of

scientific medicine bearing on the treatment of disease. Since the publication of his work, the author regrets that, some so-called "drugless healers" are exploiting the term spondylotherapy to abet their exclusive methods of practice. For the benefit of physicians who cannot master some of the details of spondylotherapy, a practical course is given on this subject by the author from time to time.

ALBERT ABRAMS.

246 POWELL STREET,
SAN FRANCISCO, CAL.,
FEBRUARY 1912.

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SPONDYLOTHERAPY

CHAPTER I.

HISTORICAL.

PRIMITIVE ERA OF SPONDYLOTHERAPEUTICS—THE GRIFFIN BROTHERS —SWEDISH GYMNASTS—OSTEOPATHY—CHIROPRACTIC—DANA—QUINCKE—HEAD—THE VERTEBRAL REFLEXES.

IN the primitive era of hydrotherapy, the application to the spinal region of the hot-water bag and ice-bag was a conventional procedure dictated by empiricism with little physiologic knowledge concerning the action of water on the spinal centers. Even at the present day, our therapeutic armament embraces various physical methods which are indiscriminately employed with neither rhyme nor reason. Thus therapeutics is discredited and any good results achieved from treatment are attributed to suggestion. We dare not wholly ignore the physical methods of treatment even though there is no physiologic reason to justify their employment, although it should be the constant effort of the physician to rationalize his methods. We are not justified in discrediting clinical observations because they have not been confirmed in the laboratories. Gowers observes, "The diseases of which we know the least pathology are the diseases which we treat successfully."

We should be prepared to welcome new truths, even though, as Gœthe observed, they threaten to overturn beliefs which we have entertained for years and have handed down to others.

One must not forget, however, the unconscious tendency of specialists to exaggerate the importance of some special method of treatment.

In the presence of abdominal pain, the surgeon who uses his head as well as his knife thinks of appendicitis, but when he uses his knife to the exclusion of his head, he thinks of nothing else. There is the gynecologist whose conception of disease is limited to the uterus and adnexa, and there is the oculist with mental astigmatism, who reflects his subjectivity in the examination of his patients.

We all know the tendency to patronize special organs, diseases or remedies, and the poet Crabbe, in verse, thus immortalizes this tendency:

> "One to the gout contracts all human pain,
> He views it raging in the frantic brain;
> Finds it in fevers, all his efforts mar,
> And sees it lurking in the cold catarrh.
> Bilious by some, by others nervous seen,
> Rage the fantastic demons of the spleen;
> And every symptom of the strange disease,
> With every system of the sage agrees."

THE GRIFFIN BROTHERS.

In 1834 William and Daniel Griffin, physicians, respectively, of Edinburgh and London, published a work in which 148 cases were analyzed showing the relation of certain symptoms to definite spinal regions. These symptoms were associated with spinal tenderness in fixed regions. They concluded that the tenderness in question was either primary in the spinal cord or secondary to visceral or other diseases. The Griffin Brothers queried as follows: "We should like to learn why pressure on a particular vertebra increases, or excites, the disease about which we are consulted, why it at one time excites headache or croup or sickness of the stomach." "Why, in some instances, any of these complaints may be called up at will by touching a corresponding point

of the spinal chain?" The following table by the Griffin Brothers[1] demonstrates the tender areas of the spine:

CASES.	PROMINENT SYMPTOMS.
Twenty-eight cases of cervical tenderness, 8 men; 8 married, 12 unmarried.	Headache, nausea or vomiting, face-ache, fits of insensibility, affections of the upper extremities. In 2 cases only, pain of stomach; In 5, nausea and vomiting.
Forty-six cases of cervical and dorsal tenderness, 7, 15 married, 24 unmarried.	In addition to the foregoing symptoms, pain of stomach and sides, pyrosis, palpitation, oppression. In 34 cases, pain of stomach. In 10 cases, nausea or vomiting.
Twenty-three cases of dorsal tenderness, 4, 0 - - 6 married, 16 unmarried.	Pain in stomach and sides, cough, oppression, fits of syncope, hiccough, eructations. In one case only, nausea and vomiting. In almost all, pain of stomach.
Fifteen cases of dorsal and lumbar; 1 man; 11 married, 3 unmarried.	Pain in abdomen, loins, hips, lower extremities, dysury, ischury in addition to the symptoms attendant on tenderness of the dorsal. In 1 case only, nausea.
Thirteen cases of lumbar tenderness.	Pains in lower part of abdomen, dysury, ischury, pains in testes or lower extremities, or disposition to paralysis. In 1 case only, spasms of stomach and retching.
Twenty-three cases, all of the spine, 4, 0 --4 married, 15 unmarried.	Combines the symptoms of all the foregoing cases.
Five cases; no tenderness of the spine.	Cases resembling the foregoing.

At this period (1834) Swedish gymnasts, notably Ling, observed among cardiopaths, tenderness over the 4th or 5th dorsal nerves when this region was subjected to friction. The Swedish school recognizes definite areas of spinal tenderness identified with the various organs. Thus, in affections of the stomach, tenderness is observed in the region of the 6th, 7th and 8th dorsal nerves on the left side, and manipulation of the region in question often evokes eructations of gas.

In 1841 Marshall Hall published his memorable work which established the importance of the spinal reflex.

OSTEOPATHY.

In 1874 osteopathy was founded. It was based on the theory that health signifies a natural flow of blood and that the bones may be employed as levers to relieve pressure on nerves, veins and arteries. The pressure is assumed to be caused by dislocated bones, and, when the osteopath refers to a "lesion," he intimates malposition of a bone.

The theory of the osteopath may be at variance with our accepted views of etiology, yet the latter, by his manipulations, unconsciously evokes reflexes which are cogent factors in favorably influencing disease.

The osteopath indignantly resents any comparison of his system to massage. The following statement occurs in a representative work on this system by G. D. Hulett[2]: "Masseurs are aware of the fact and the possible significance of tender points in the tissues along the spine over the area from which the nerves are given off to the organs which are in a diseased condition; evidently, however, they have considered these tender points as always secondary to the diseased viscus." "The essential distinction between osteopathy and all other systems of healing," continues the same

writer, "based on manipulation, clusters around the etiology of disease." In other words, in disease of an organ, the masseur acts directly upon the organ; but the osteopath taking into consideration what he regards as a fact "The ability of nature to functionate properly, treats the central force."

According to the foregoing, the osteopath regards disease from a central and not from a peripheral standpoint.

CHIROPRACTIC.

This system was founded in 1885. The theory sustaining this system presumes that, in consequence of displaced vertebræ, the intervertebral foramina are occluded through which the spinal nerves pass (Fig. 1).

In this way the nerves are pinched and chiropractors assume that such pinching is responsible for 95 per cent of all diseases. Chiropractic concerns itself with an "adjustment" of the subluxations, thus removing pressure on the nerves.

What the chiropractor calls "nerve-tracing," consists of following a sensitive nerve from its vertebral exit to and from the affected organs. The chiropractor differentiates his method from osteopathy by the following asseverations:

1. The hands are used in a different manner and the movements are dissimilar;
2. The etiology of disease is unlike that accepted by osteopathy;
3. Chiropractors "adjust" for more diseases than osteopaths and the results are immediate.

It is known that pain may be felt at a point distant from the actual site of a lesion. Such pains are know as TRANSFERRED PAINS. Thus the pains sometimes felt in the

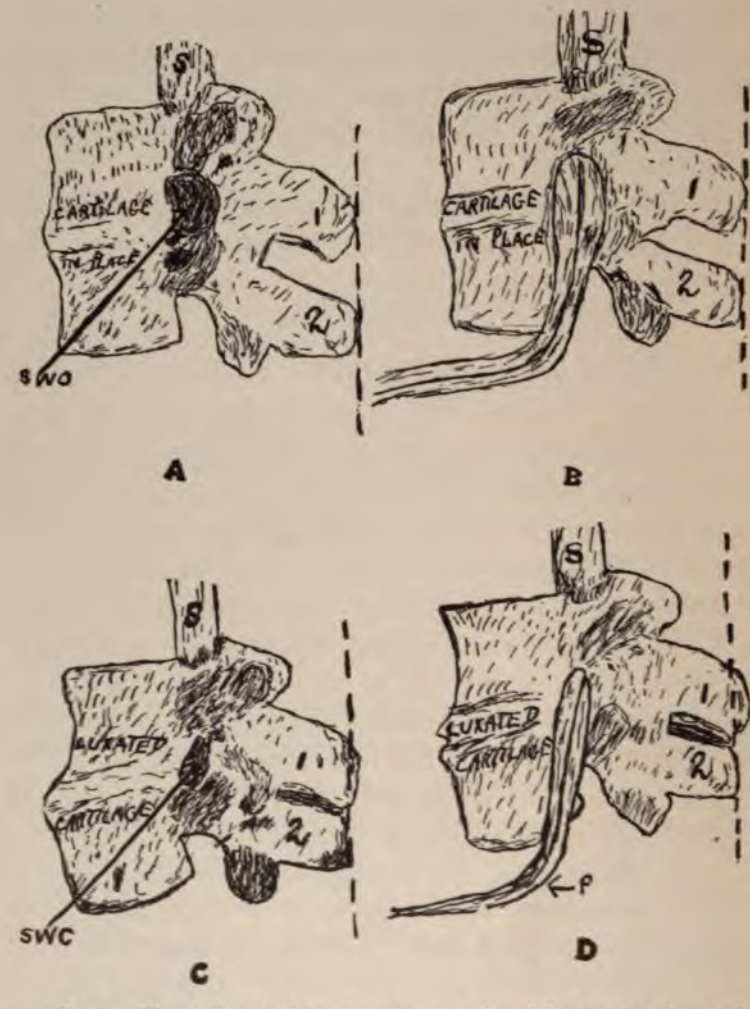

FIG. 1.—Illustrating the chiropractor's conception of disease. A, the vertebræ are in the normal position with the spinal window open (SWO); B, showing that with an open spinal window the nerve is not compressed. The dotted lines show the correct alignment of the spinous processes; C, the spinal window is closed (SWC) owing to displaced vertebræ and in consequence the nerve at its exit is pinched (D). (After Palmer.)

mammary gland in uterine disease and in the knee in hip-joint disease are transferred or referred pains.

The well-known illustrations of Dana (page 56) represent the location of transferred pains.

In 1890 Quincke studied the sites of SYMPATHETIC SENSATIONS (page 57).

Still later, in 1893, Henry Head, of London, demonstrated that in visceral disease, pain and disturbed sensation may be referred to definite cutaneous areas (*vide* page 58).

THE VERTEBRAL REFLEXES.

In medical literature the author has referred repeatedly to certain VISCERAL REFLEXES elicited by cutaneous irritation, viz., the *lung reflexes* of dilatation[3] and contraction[4], the *heart reflex*[5], *liver reflex*[6], *stomach and intestinal reflexes*[7], and the *aortic reflexes*[8].

The reflexes in question are endowed with more than mere physiologic interest. They yield unequivocal demonstration of the fact that the sensory peripheral nerve terminations receive impressions which are conducted, communicated or reflected by aid of the nervous system.

Such impressions react on the viscera and the manifestations of the reaction may be utilized in a diagnostic and therapeutic direction.

The evidence heretofore adduced in explanation of the results achieved by electric, hydriatic, mechanic and balneary treatment of disease was naught else than a mere array of words conceived only in conjecture.

The cutaneous visceral reflexes referred to, suggest the rationale of the different peripheral methods of treatment.

Visceral reflexes may be evoked not only by cutaneous irritation but likewise by concussion and the application of

the sinusoidal current to the spinous processes of the vertebræ.

Reflexes elicited from the spinous processes have been specified by the author as VERTEBRAL REFLEXES.[9]

The manipulation of definite vertebræ corresponds with the elicitation of specific reflexes, but, if the spinous processes are promiscuously manipulated, counter-reflexes are evoked which nullify the reflexes sought. As we proceed with our subject, we will determine that vertebral manipulation is influential for weal or woe in the treatment of disease and it will be the endeavor of the author, to endow spondylotherapeutics with some scientific accuracy and thus substitute order for chaos.

To excite the vertebral reflexes for therapeutic purposes, concussion by means of an apparatus (page 176) or the sinusoidal current (page 151) is employed. For diagnostic purposes, either the sinusoidal current or simple concussion after the manner to be described is used. When the current is employed, the moistened, indifferent pad (usually large) is placed over the sacral region, whereas an interrupting electrode (Fig. 46), which permits one to close and open the circuit, is placed over definite spinal processes.

For simple concussion the author employs a piece of soft rubber or linoleum about 6 inches long, 1½ inches wide, and about a ¼ of an inch in thickness as a pleximeter for receiving the stroke and a plexor with a large piece of thick rubber for delivering the blow (Fig. 2).

The plexor used by the author is similar to that employed by French clinicians for obtaining the knee-jerk and is known as the plexor of Déjérine.

In the absence of the latter, a mallet or even an ordinary tack-hammer will suffice.

One may also strike the spinous processes with the

FIG. 2.—Plexor and pleximeter employed for eliciting the vertebral reflexes.

knuckles or better still, the fingers may be used as a pleximeter and the clenched fist as a plexor. In the latter instance, the palmar surfaces of the fingers are applied to the spinous processes to be concussed, and, with the clenched fist, the dorsal surfaces of the fingers are struck a series of short and vigorous blows (Fig. 3).

The use of a pleximeter and plexor is decidedly more effective than the latter method which is only employed in an emergency. Here the strip of linoleum or rubber is applied to the spinous process or processes to be concussed, and, with the hammer, a series of sharp and vigorous blows are allowed to fall upon the pleximeter.

FIG. 3.—Showing the method of concussing the spinous processes with the hands for eliciting the vertebral reflexes.

Naturally, the blows jar the patient somewhat, but beyond this no inconvenience is suffered.

The vertebral reflexes, when the stimulant is concussion, are probably due to transmitted mechanic stimulation of the roots of the spinal nerves, insomuch as many physiologists contend that the spinal cord does not react to direct stimuli. In some instances concussion is more effective than the sinusoidal current in eliciting certain vertebral reflexes, whereas, in other instances, the current supersedes concussion. The relative value of these methods, however, will be studied in detail in succeeding chapters. There is yet another method for eliciting the vertebral reflexes by means of

pressure at the vertebral exits of definite spinal nerves (page 169).

Reference to Fig. 4 shows the spinal muscular reflexes thus far elicited by the author, whereas, Fig. 5 represents the viscero-motor reflexes of spinal origin. The latter, with the exception of the aortic reflexes, probably act on the musculature of the organs independently of the vaso-motor system.

Unstriped or involuntary muscular fibers are present in practically all the organs of the body. Even the liver is not exempt. Here the muscular fibers contained in the fibrous coat of the organ enter the organ at the transverse fissure.

The viscera, even in health, vary in size, and this alternate enlargement and diminution in bulk is due in part to variations in the supply of blood and in part to the contractility of the visceral musculature.

If I am permitted to digress for a moment to give expression to my prejudiced conception of many morbid manifestations, I witness muscular tissue in a state of incoordination, uncontrolled by will and subordinated to the vagaries of undisciplined reflex centers, the muscular orgy presents the tableau of muscles gone mad. Practically everywhere throughout the organism where muscle is found, fibers coexist which dilate or contract. When neither function predominates there are no morbid manifestations; in other words, a normal function is a question of muscular equilibrium. The moment one set of fibers gains the ascendancy over its antagonist the symptomatic picture is made up of spasm or paralysis (*vide* Asthma, page 303).

SPINAL MUSCULAR REFLEXES.

These reflexes are best elicited by means of a powerful sinusoidal current after the manner already described (page 11). Concussion by means of the plexor and pleximeter

will also excite some of them. It will be observed that the reflexes in question are bilateral, in contradistinction to the conventional cutaneo-peripheral reflexes, which are unilateral.

For the convenience of their clinical elicitation they have been studied with relation to definite vertebral spinous processes.

It must be observed, however, that the areas in question may vary in different patients, but, as here cited, the areas are approximately correct. Like all reflexes, the degree of stimulation necessary for their excitation varies with the individual, but, as a rule, powerful currents are necessary. Practically every muscle, or group of muscles, may be brought to contraction, but, insomuch as this work is designed for a utilitarian rather than an academic purpose, only a few muscular reflexes thus far elicited by the author will be cited.

1. STERNO-CLEIDO-MASTOID REFLEX.—This is best observed when the head is flexed and when the interrupting electrode is fixed over the spinous process of the 7th cervical vertebra. Concussion of the latter will also evoke the reflex. This bilateral reflex is most pronounced at the sterno-clavicular attachment of the muscles.

2. BICEPS, TRICEPS, AND WRIST-JERK.—Elicited by concussion of the spinous processes of the 5th and 6th cervical vertebræ or by application of the current to the same processes. Here the processes are concussed in succession or the electrode used is large enough to embrace both spinous processes. The upper extremities must be placed in a state of flexion, with muscles absolutely relaxed and the elbows resting in either hand of an assistant. The elbows may also rest on a table in the flexed position and relaxed.

3. PALMAR REFLEX.—This consists of a contraction of two or more fingers when the interrupting electrode is applied over the spinous process of the 6th cervical vertebra.

4. PECTORAL REFLEX.—The patient lies on his side with arms elevated to bring the pectoral muscles into slight prominence, after which the dorsal spinous processes (3d to the 6th) are either concussed or sinusoidalized.

5. SCAPULAR REFLEX.—Concussion or sinusoidalization of the 5th cervical spinous process.

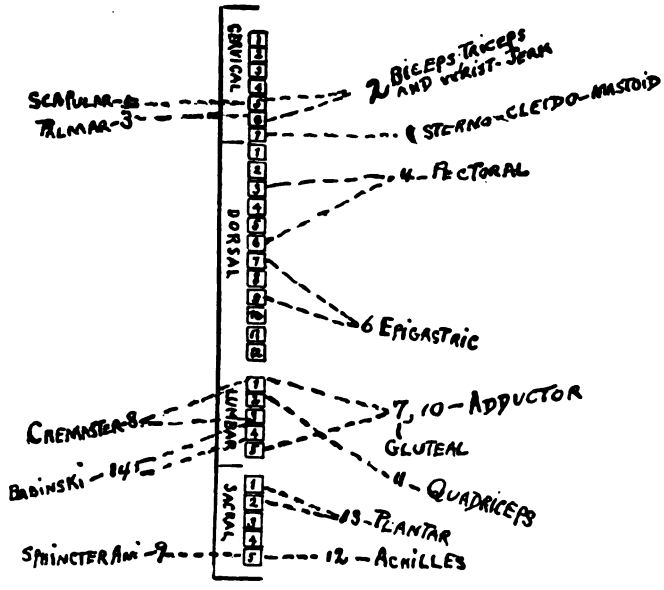

FIG. 4.—The spinal muscular reflexes.

6. EPIGASTRIC REFLEX.—Concussion or sinusoidalization of the dorsal spinous processes (7th to the 9th).

7. GLUTEAL REFLEX.—When the patient is on his side sinusoidalization or concussion of any of the lumbar vertebræ. The reflex is accentuated as the last lumbar vertebra is attained.

8. CREMASTERIC REFLEX.—When the 1st, 2nd and 3d lumbar vertebræ are concussed or sinusoidalized.

9. SPHINCTER ANI REFLEX.—Sinusoidalization with a small electrode at a point corresponding to the sacro-coccygeal articulation.

10. ADDUCTOR REFLEX.—Adduction of both lower extremities when the spinous processes of all the lumbar vertebræ are sinusoidalized or concussed. The patient sits on a chair with both lower extremities extended and relaxed.

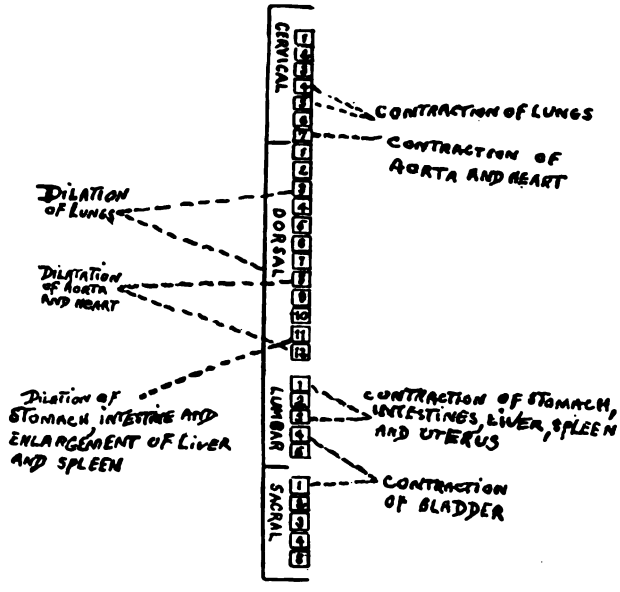

FIG. 5.—Viscero-motor reflexes of spinal origin.

11. QUADRICEPS REFLEX.—With the patient seated and legs extended, concussion or sinusoidalization of the spinous process of the 2nd lumbar vertebra will produce a decided contraction of the quadriceps femoris. It may be noted that it is a contraction of this muscle which is responsible for the patellar reflex (*knee-jerk*). When one leg is crossed upon the other (the conventional position for eliciting the knee-jerk), a knee-jerk can be obtained in the norm. In

several tabetics in whom the knee-jerk was absent (by tapping the patellar tendon) it was very much exaggerated in either one or the other leg when one leg was crossed upon the other during sinusoidalization (with the interrupting electrode) of the spinous process of the 2nd lumbar vertebra.

The foregoing phenomenon is discussed on page 28.

12. ACHILLES REFLEX.—The patient rests on his knees on a chair, with feet projecting over the edge of the latter. In the conventional way, striking the Achilles tendon results in flexion of the foot.

With the patient in the same position the interrupting electrode is fixed over the sacrococcygeal articulation, whereas the large pad is applied in the lumbar region. Here, likewise, the current evokes flexion of the foot.

13. PLANTAR REFLEX.—Evoked by sinusoidalization of the 1st and 2nd sacral segments.

14. BABINSKI REFLEX.—If, in the norm, we irritate the inner side of the sole of the foot from the heel to the toes by stroking with a moderately sharp object, all the toes undergo plantar flexion; but, if the great toe (and perhaps the other toes) undergoes dorsal flexion (Fig. 6), the Babinski reflex or phenomenon is present. As a rule the latter phenomenon indicates a lesion of the pyramidal tract.

The observations of the author show that the Babinski reflex may be elicited in the norm by applying the interrupting electrode (large electrode over the sacrum) over the spinous process of either the 3d or 4th lumbar vertebra.

Schneider's explanation of the Babinski reflex is as follows; Plantar flexion of the toes (the normal reflex) depends upon a cortical component of the reflex, whereas dorsal flexion of the toes (Babinski reflex) depends on the spinal component. If then, there is a lesion of the pyramidal tract, the reflex for the plantar flexion is interrupted, whereas

the spinal component for dorsal flexion is retained. In several cases with lesions of the pyramidal tract observed by the author, and in all of whom the Babinski reflex was present by irritating the sole of the foot, the same reflex could not be elicited as in the norm by sinusoidalization of the spinal column. In these cases, however, the plantar reflex was elicited by sinusoidalization in lieu of the Babinski reflex,

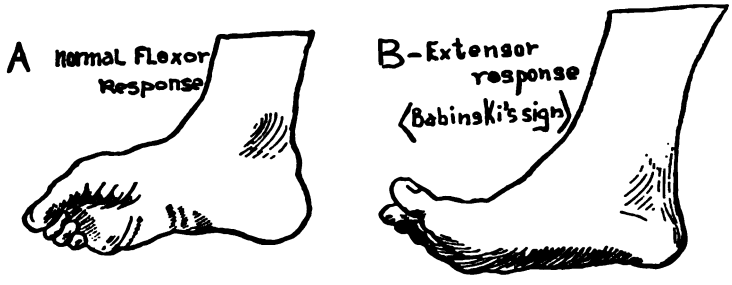

FIG. 6.—The Babinski toe-reflex (Hutchison and Rainy).

which occurs in the normal subject. The latter observation would seem to show in part the correctness of Schneider's explanation of the Babinski reflex. The occurrence of the plantar reflex in these cases suggests that it is likewise a spinal and not a cortical reflex and that its occurrence in lieu of the Babinski by sinusoidalization is equally diagnostic of a lesion of the pyramidal tract.

The physician will observe that the spinal muscular reflexes (provided the current remains in action for several seconds) consist of clonic rather than tonic contractions, and, furthermore, that the spinal reflexes may be elicited even though the ordinary cutaneo-peripheral reflexes are absent.

CHAPTER II.

ANATOMIC, TOPOGRAPHIC AND PHYSIOLOGIC DATA.

STRUCTURE OF THE SPINAL CORD—ROOTS AND DISTRIBUTION OF THE SPINAL NERVES—LOCATION OF THE SPINAL NERVES—ANATOMIC LANDMARKS—SYMPATHETIC SYSTEM—PHYSIOLOGY OF THE SPINAL CORD—LOCALIZATION OF THE FUNCTIONS IN DIFFERENT SEGMENTS OF THE SPINAL CORD.

A transverse section of the spinal cord (Fig. 7) shows it to consist of central gray matter containing nerve-cells and

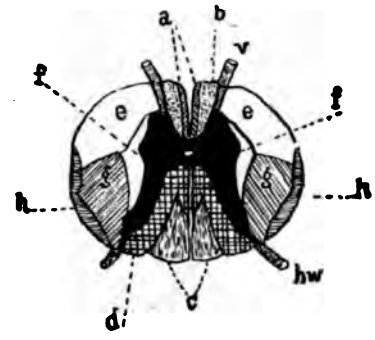

FIG. 7.—Illustrating the conducting paths in the spinal cord at the level of the third dorsal nerve. The black part represents the gray matter; V, anterior, and HW, posterior root; A, direct, and G, crossed pyramidal tracts; B, anterior column ground bundle; C, Goll's column; D, postero-external column; E and F, mixed lateral paths; H, direct cerebellar tracts (Landois).

surrounding white matter made up of nerve-fibers. The gray matter is divided into the anterior and posterior horns. The SPINAL NERVES take their origin from the spinal cord and on either side make their exit through the intervertebral foramina. There are 31 pairs of spinal nerves:

Cervical nerves	.....	8	pairs
Dorsal "	.....	12	"
Lumbar "	.....	5	"
Sacral "	.....	5	"
Coccygeal "	.....	1	pair

ROOTS OF THE SPINAL NERVES.

The anterior or ventral roots arise from the motor cells in the anterior horn of the gray matter and are *motor* in function. The posterior or dorsal roots arise from the nerve-cells of the spinal ganglia from which they can be traced into the cord and are *sensory* in function.

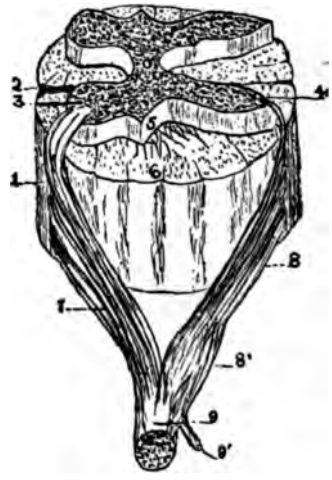

FIG. 8.—A spinal nerve with its anterior and posterior roots (Testut). 1, a portion of the spinal cord viewed from the left side; 2, anterior median fissure; 3, anterior horn; 4, posterior horn; 6, formatio reticularis; 7, anterior root; 8, posterior root with 8^1, its ganglion; 9, spinal nerve; 9^1, its posterior division.

On the posterior root of each of the spinal nerves, a ganglion is found which is located in the intervertebral foramen external to the point where the nerve perforates the dura mater (Figs. 8 and 38).

DISTRIBUTION OF THE SPINAL NERVES.

Just beyond the ganglion, the roots of the spinal nerves unite to form a trunk which constitutes the *spinal nerve.*

After the latter passes out of the intervertebral foramen, it divides into a posterior division for the supply of the pos-

terior part of the body and an anterior division which supplies the anterior part of the body. In each division there are fibers from the roots of both nerves.

Each spinal nerve receives a branch from the sympathetic (Fig. 9).

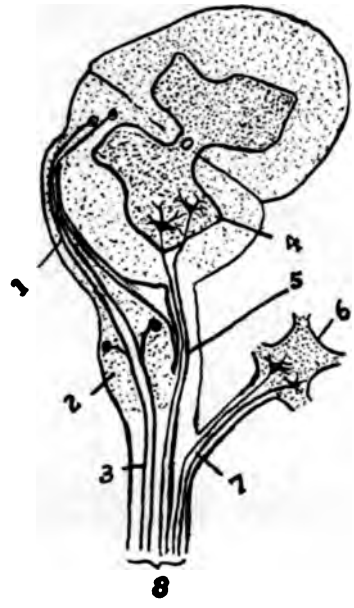

FIG. 9.—Diagram after Böhm and Davidoff to show the composition of a peripheral nerve-trunk. 1, axon of ganglion-cell; 2, spinal ganglion; 3, dendrite of ganglion-cell; 4, anterior horn of gray matter of spinal cord; 5, axon of motor nerve-cell; 6, sympathetic ganglion; 7, axon of sympathetic neuron; 8, nerve-trunk.

The roots of the majority of spinal nerves pass obliquely downwards and outwards to their points of exit from the intervertebral foramina, hence the level of their emergence from the cord does not correspond to that of their exit from the intervertebral foramina (Fig. 10).

ANATOMIC LANDMARKS.

There is usually a furrow or medium groove in the back, at the bottom of which lie the spinous processes. In

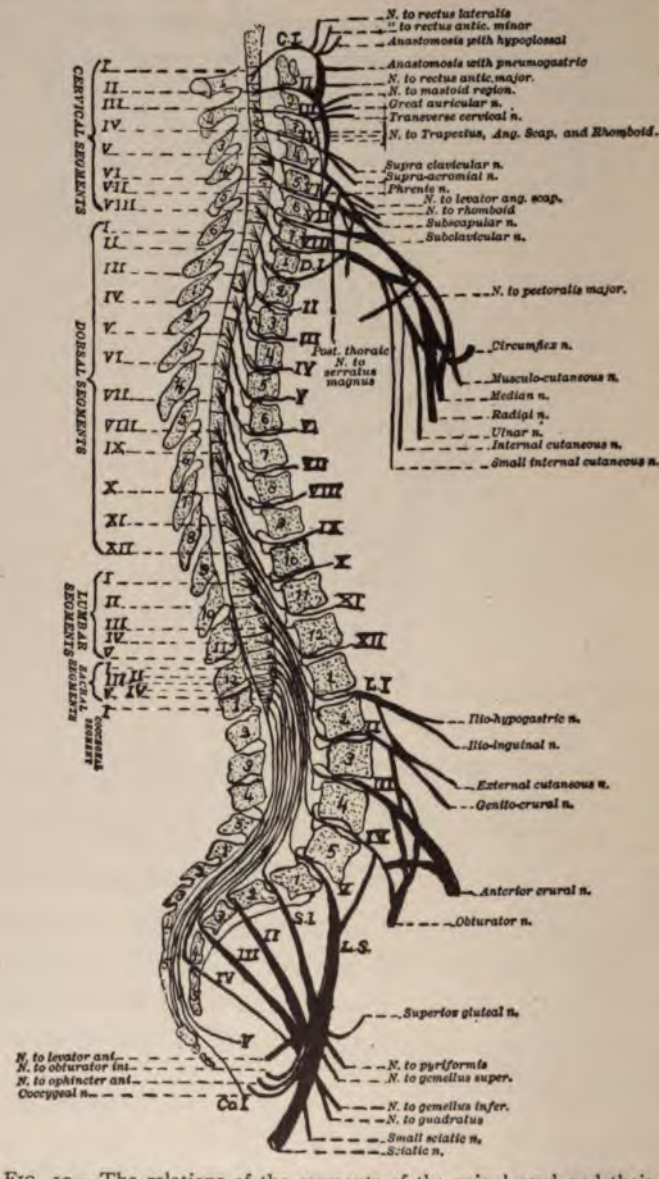

FIG. 10.—The relations of the segments of the spinal cord and their nerve-roots to the bodies and spines of the vertebræ (Déjérine et Thomas, modified by Starr).

emaciated individuals the spinous line replaces the groove. The spinal furrow is less evident in the cervical than in the lumbar region; in the former situation it is between the trapezii and between the larger erector spinæ muscles in the dorsal and lumbar regions.

Palpation and definition of the vertebral spinous processes are facilitated by directing the patient to lean far forward or the processes may be rubbed with the hand, thus evoking a spot of hyperemic redness over the tip of each spinous process.

The 5th lumbar spine (marked by a depression) is used for measuring the external conjugate diameter of the pelvis. The latter diameter from the depression to the upper border of the symphysis pubis measures 20¼ cm. or 8½ inches. The two posterior superior spinous processes of the ilium are on a line with the 3d sacral spine below which lie the sacro-iliac joints.

PETIT'S TRIANGLE is a triangular space corresponding to the central point of the crest of the ilium (Fig. 47).

This triangle is the occasional site of a lumbar hernia and is also a convenient region for relieving congestion of the kidney by local bleeding.

Deep pressure made in the neck in the direction of the carotid artery and opposite the cricoid cartilage detects a tubercle belonging to the transverse process of the 6th cervical vertebra and is known as CHASSAIGNAC'S TUBERCLE. Against the latter the carotid artery may be compressed by the finger.

The VERTEBRAL ARTERY may be compressed in the suboccipital region, the thumb and finger of one hand being placed in the hollows behind the mastoid process, while counterpressure is made by the other hand on the forehead. As the arteries lie under the complexus muscle, the pressure

must be rather firm. If such pressure inhibits pulsating noises or vertiginous feelings, the inference is that, these are caused by congestion in regions supplied by branches of the

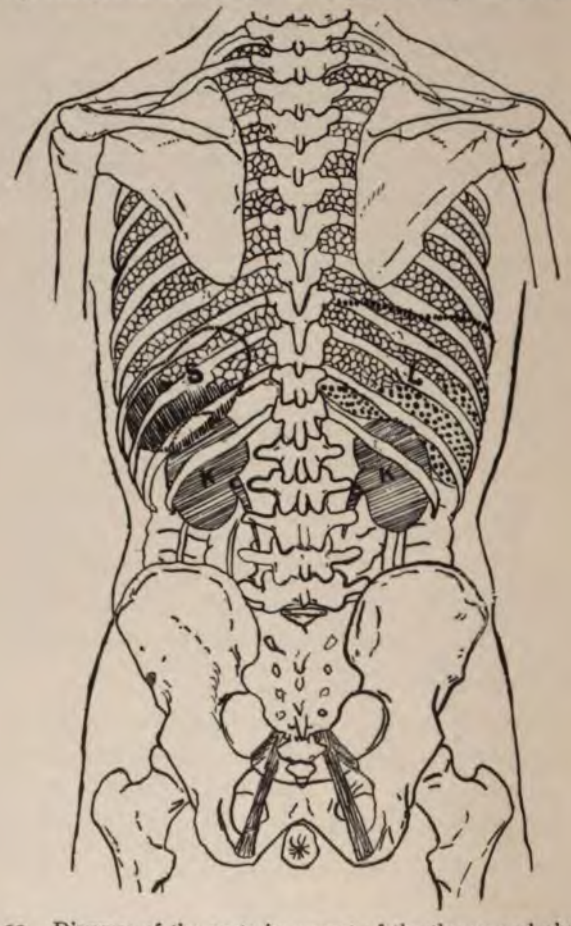

FIG. 11.—Diagram of the posterior aspect of the thorax and abdomen and showing the relation of the viscera to the surface. Liver (L); spleen (S); kidneys and ureters (KU).

basilar artery (internal ear). If noises in the ear are diminished by compression of the carotid artery, they are probably caused by congestion in the middle or external ear, and are often synchronous with the pulse.

LANDMARKS.

SPINES OF THE VERTEBRAE.	RELATION.
Atlas.	On a line with the hard palate. The transverse process is just below and in front of the tip of the mastoid process.
Axis.	Felt beneath the occiput and is on a level with the free edge of the upper teeth.
4th cervical vertebra.	Opposite the hyoid bone.
6th cervical vertebra.	On a line with the cricoid cartilage. Esophagus commences.
7th cervical vertebra (*Vertebra prominens*)	Easily recognized, owing to its prominence and serves as a guide for counting the processes downwards. Location of the inferior cervical ganglion.
2d dorsal spine.	Corresponds to the head of the 3d rib. The scapula covers the ribs from the 2nd to the 7th, inclusive. The apex of the lower lobe of the lung is at the level of the 3d rib behind.
3d dorsal spine.	Corresponds to the inner edge of the spine of the scapula. Termination of the arch of the aorta on the left side.
4th dorsal vertebra.	Opposite the junction of the 1st and 2nd section of the sternum. Thoracic aorta commences to the left. Trachea bifurcates midway between the 3d and 4th dorsal spines, the roots of the lungs thus lying a little below and external.
7th dorsal spine.	Corresponds to the inferior angle of the scapula when the patient is sitting with the arms hanging at the side.
10th dorsal vertebra.	Corresponds to the tip of the ensiform cartilage. Lower edge of lung posteriorly. Cardiac orifice of the stomach.
12th dorsal spine.	Corresponds to the head of the last rib. Aortic orifice in diaphragm.
4th lumbar spine.	Highest point of the crest of the ilium. The umbilicus is near the same plane. Division of the aorta. Below the tip of this spine, point of election for *lumbar puncture*. The disk of this vertebra corresponds to the ileo-cecal valve.

LOCALIZATION OF THE SPINAL NERVES.

In the adult, as a rule, the spinal cord extends from the lower surface of the foramen magnum to the lower edge of the 1st lumbar vertebra, and only exceptionally as far as the 2nd lumbar vertebra.

The position of the cord shows slight alterations in position in the movements of the body. Thus it rises during spinal flexion. The root-origin of the spinal nerves may be determined as follows (Consult Fig. 10):

For the upper 4 CERVICAL NERVES subtract 1 from the number of the nerve.	Thus the root-origin of the 3d cervical is opposite the 2nd cervical spine.
For the 4 lower cervical nerves and upper 6 DORSAL NERVES, subtract 2 from the number of each nerve.	Thus the root-origin of the 8th cervical nerve corresponds to the 6th cervical spine.
For the lower 6 dorsal nerves subtract 3 from the number of the nerve.	Thus the root-origin of the 9th dorsal is opposite the 6th dorsal spine.

The LUMBAR NERVES take their origin contiguous to the 10th and 11th dorsal spines and the SACRAL NERVES between the 11th dorsal and 1st lumbar spines.

THE SYMPATHETIC SYSTEM.

This portion of the nervous system is concerned in the distribution of impulses to the glandular structures, cardiac muscle and the non-striated muscular tissue of the body. While this system is not supposed to be independent in action of the cerebro-spinal system, Langley employs the term *autonomic* to indicate that the efferent fibers of the sympathetic are endowed with a certain independence of the central nervous system. The autonomic fibers are removed from the control of the will and preside over unconscious

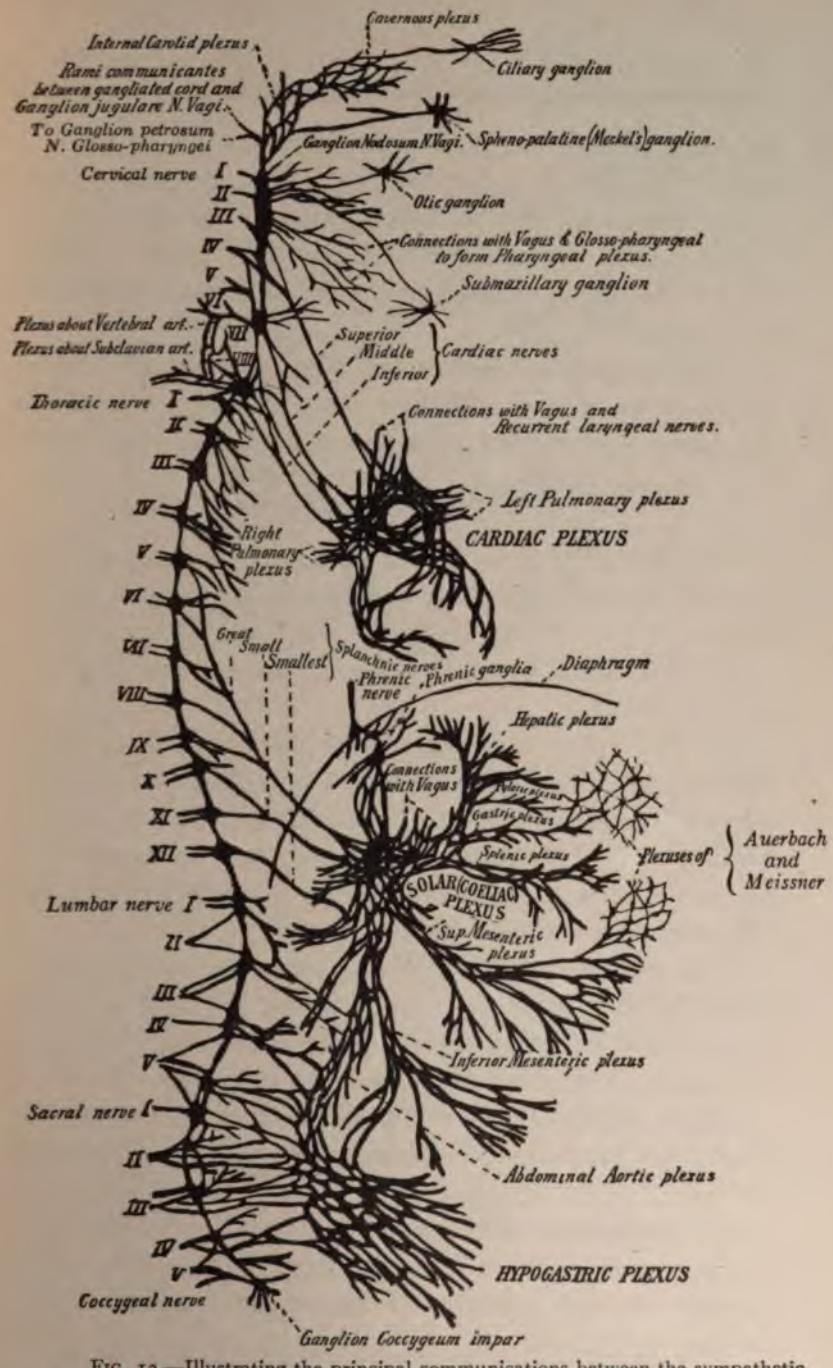

FIG. 12.—Illustrating the principal communications between the sympathetic and cerebro-spinal nervous system (Flower, modified by Morris).

reflexes like intestinal peristalsis, contraction and dilation of the arteries and the secretory activity of the digestive glands. The sympathetic system communicates with the cerebro-spinal system, by means of efferent and afferent nerves. Fig. 12 shows the principal communications between the two systems.

The sympathetic nerves are now regarded as carrying chiefly motor fibers, and their cell-origin is most probably the lateral horns on the same side of the spinal cord.

THE PHYSIOLOGY OF THE SPINAL CORD.

The spinal cord has a dual function; it acts as an independent central organ and as a conductor of nervous impulses.

Reference will be made primarily to the spinal cord as a REFLEX CENTER.

A reflex refers to involuntary production of activity in a part brought about by conduction of a stimulus along an afferent (sensory) nerve to the motor cells in the cord or medulla. This stimulus is converted into an impulse by the motor cells, which impulse is then conducted to a part by means of an efferent (motor) nerve.

The mechanism of the reflex known as the knee-jerk is illustrated in Fig. 13. To elicit this reflex, it is necessary to have an intact REFLEX ARC, otherwise the reflex is abolished. The reflex arc is made up as follows:

1. A healthy tendon which, when struck with a hammer, constitutes the peripheral stimulus which is then conducted by—

2, an afferent (sensory) nerve along the posterior roots to the anterior horn of the spinal cord where, by means of the motor cells, it is converted into an impulse which is then conducted by means of

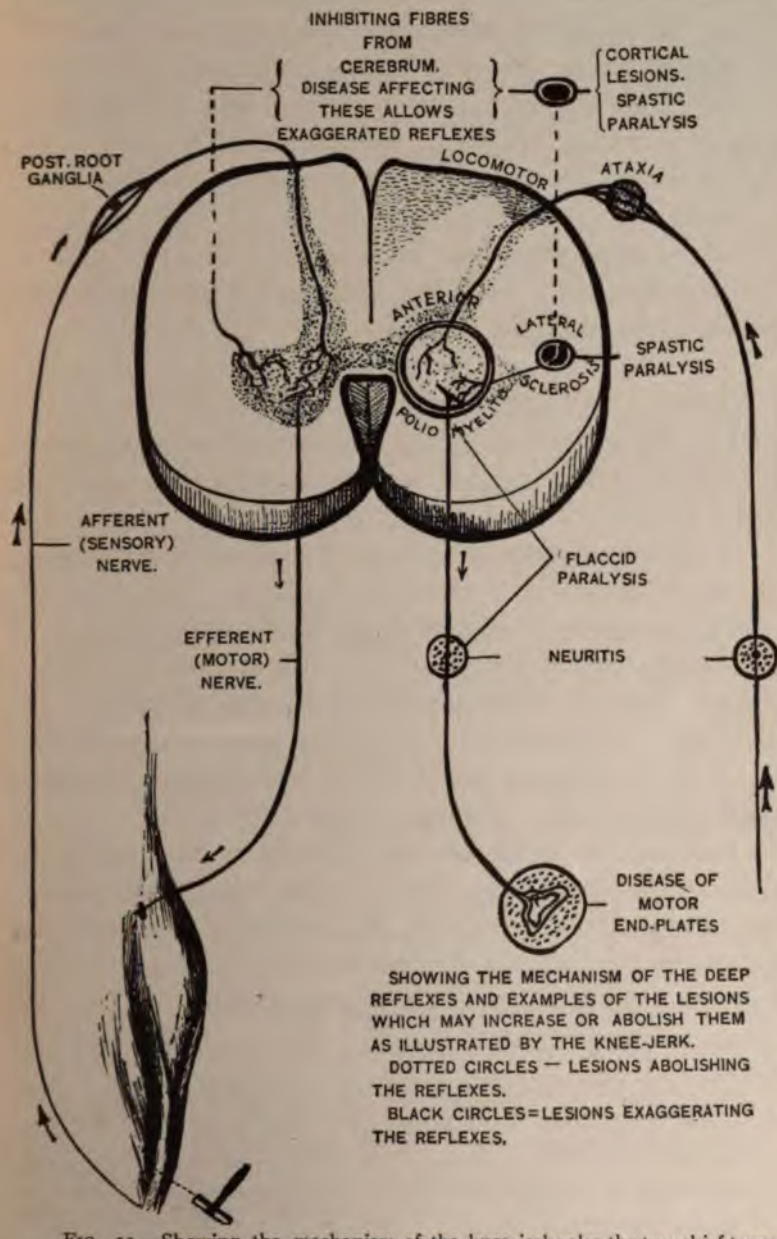

FIG. 13.—Showing the mechanism of the knee-jerk; also the two chief types (spastic and flaccid) of paralysis (Butler).

3, an efferent (motor) nerve to a healthy muscle.

The text-books usually describe the following reflexes:

1. Superficial or cutaneous elicited by irritation of the skin or a mucous membrane resulting in contraction of the muscles contiguous to the site of irritation;

2. Deep or tendon reflexes elicited by striking a tendon, muscle or periosteum near the tendon;

3. Organic or visceral reflexes which result in special acts like urination and defecation.

The reader is referred to page 7, where consideration was given to the vertebral reflexes. The latter are essentially central and are elicited by concussion or sinusoidalization of the spinous processes of definite vertebræ and by pressure at the vertebral exits of the spinal nerves.

A single paradigm may be cited to show the importance of the central vertebral reflexes in diagnosis. In LOCOMOTOR ATAXIA the posterior root-fibers in the posterior columns in the lumbar region are involved, in consequence of which the knee-jerk* is diminished or usually abolished.

The knee-jerk would be similarly influenced in lesions involving the anterior horns of the gray matter by cutting off the motor path. In other words, to elicit the knee-jerk the reflex arc in the lumbar cord must be intact. Reference to Fig. 14 shows that the center for the knee-jerk is located in segment III, of the medulla lumbalis and reference to Fig. 4, shows that the quadriceps reflex (central vertebral reflex) corresponds practically to the same site.

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*The knee-jerk reflex arc is made up of nerve-fibers which pass to and from the crureus (one of the four muscles constituting the quadriceps extensor) by the anterior crural nerve and to and from the hamstrings by the sciatic nerve. The nerves to the crureus arise from the spinal nerve-roots corresponding to the 3rd and 4th lumbar; the hamstring supply is from the 5th lumbar and 1st and 2nd sacral roots. It will be noted that concussion will not elicit the knee-jerk. Here it is necessary to sinusoidalize simultaneously the 2nd lumbar vertebra and the sacral region.

Now, in locomotor ataxia, the knee-jerk is abolished, owing to involvement of a part of the reflex arc (the afferent or sensory path), and when the knee-jerk is elicited in the usual way, it may be difficult to say whether any other part of the arc in question is implicated. If one can provoke the central quadriceps reflex, one can at least conclude that the descending paths (efferent or motor) are intact. For a like reason a *peripheral neuritis* may be difficult to differentiate from locomotor ataxia owing to involvement of the peripheral sensory nerves.

In a number of patients with locomotor ataxia examined by the author, a quadriceps reflex was usually present, and in a number of instances an exaggerated knee-jerk was obtainable on either one or the other leg. Usually it was absent in the more atactic leg or in advanced stages of the disease.

Here one was constrained to conclude that when the knee-jerk was obtainable, the posterior root-fibers were not entirely destroyed. It was also found that the Achilles reflex could be elicited (corresponding to segment V of the *medulla lumbalis*, Fig. 14) in a number of cases of locomotor ataxia by sinusoidalization over the sacrococcygeal articulation.

The elicitation of the vertebral reflexes directs reference to a mooted point in physiology, viz., whether the tendon reflexes are or are not true reflexes. According to the prevailing opinion, they are not true reflexes but are due to direct stimulation of the muscle itself. The author questions the correctness of the latter observation insomuch as a veritable Achilles reflex and knee-jerk can be elicited in the norm by vertebral stimulation.*

*The author is convinced that this subject embraces a field of research of vast importance to the neurologist. Man is available for experimentation for, in the study of the vertebral reflexes, they can be evoked with an accuracy almost equal to their elicitation by vivisection.

In eliciting the knee-jerk the large electrode must be placed over the lower sacral region and the interrupting electrode over the spinous process of the 2nd lumbar vertebra and one leg crossed upon the other leg. A strong current is necessary. With some sinusoidal machines the knee-jerk cannot be evoked, but with Kellogg's apparatus (Fig. 44) it can practically always be excited.

LOCALIZATION OF FUNCTION IN THE DIFFERENT SEGMENTS OF THE SPINAL CORD.

A SPINAL SEGMENT refers to the part of the cord contained between two sets of roots. Each segment must be regarded as a unit endowed with motor, sensory, vasomotor, trophic and reflex functions with regard to the peripheral distribution of the roots of the nerves which emerge from and enter it. A segment is called after the nerve-roots which take their origin from it and not with reference to its relation to the vertebræ.

A diagrammatic representation of the spinal cord is shown in Fig. 14. The cord is divided into its four regions. Within each region the spinal segments are indicated by numbers. On the right-hand side of the diagram, muscles or groups of muscles are indicated, and the lines proceeding from them pass to the segments of the cord in which the cell-bodies of origin are located.

On the left side of this diagram the sensory regions are indicated and the lines show their relation to the different segments of the cord itself.

To determine the condition of the cord at different levels the following table[11] is serviceable. It shows the different segments controlling the skeletal muscles, the reflex centers and the chief location of the segmental skin-field.

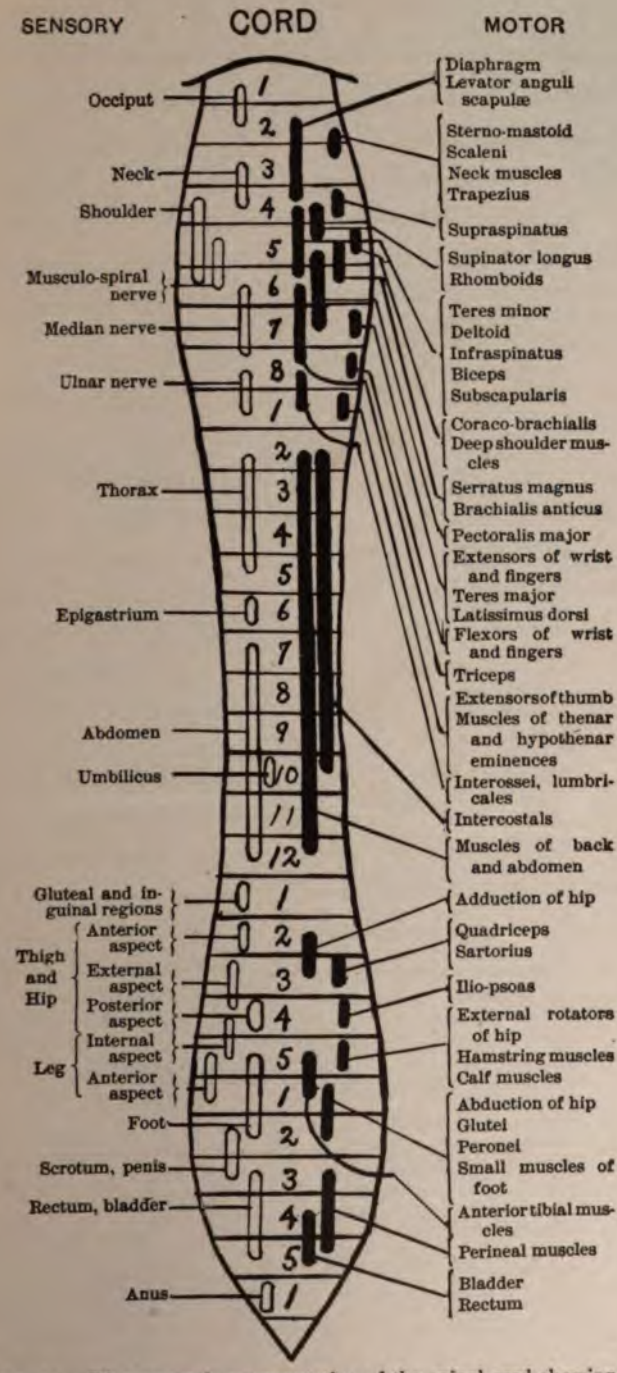


FIG. 14.—Diagrammatic representation of the spinal cord showing the spinal segments for motion and sensibility. Jakob, Starr, Sachs, Dana, Mills and Butler.

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD.

SEGMENT	STRIPED MUSCLES	REFLEX	SKIN-FIELDS
I, II, and III C.....	Splenius capitis Hyoid muscles Sterno-mastoid Trapezius Diaphragm (C III-V) Levator scapulæ (C III-V)	Hypochondrium (?) Sudden inspiration produced by sudden pressure beneath the lower border of ribs (diaphragmatic).	Back of head to vertex. Neck (upper part).
IV C.....	Trapezius Diaphragm Levator scapulæ Scaleni (C IV-DI) Teres minor Supraspinatus Rhomboid	Dilation of the pupil produced by irritation of neck. Reflex through the sympathetic (C IV-DI).	Neck (lower part to second rib). Upper shoulder.
V C.....	Diaphragm Teres minor Supra and infra spinatus (C V-VI) Rhomboid Subscapularis Deltoid Biceps Brachialis anticus Supinator longus (C V-VII) Supinator brevis (C V-VII) Pectoralis (clavicular part) Serratus magnus	Scapular (CV-DI). Irritation of skin over the scapula produces contraction of the scapular muscles. Supinator longus and biceps. Tapping their tendons produces flexion of forearm.	Outer side of shoulder and upper arm over deltoid region.
VI C.....	Teres minor and major Infraspinatus Deltoid Biceps Brachialis anticus Supinator longus Supinator brevis Pectoralis (clavicular part) Serratus magnus (C V-VIII) Coraco-brachialis Pronator teres Triceps (outer and long heads) Extensors of wrist (C VI-VIII)	Triceps. Tapping elbow tendon produces extension of forearm. Posterior wrist. Tapping tendons causes extension of hand (C VI-VII).	Outer side of forearm, front and back. Outer half of hand (?).

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD—CONTINUED.

SEGMENT	STRIPED MUSCLES	REFLEX	SKIN-FIELDS
VII C	Teres major Subscapularis Deltoid (posterior part) Pectoralis major (costal part) Pectoralis minor Serratus magnus Pronators of wrist Triceps Extensors of wrist and fingers Flexors of wrist Latissimus dorsi (C VI-VIII)	Scapulo-humeral. Tapping the inner lower edge of scapula causes adduction of the arm. Anterior wrist. Tapping anterior tendons causes flexion of wrist (C VII-VIII).	Inner side and back of arm and forearm. Radial half of the hand.
VIII C	Pectoralis major (costal part) Pronator quadratus Flexors of wrist and fingers) Latissimus Radial lumbricales and interossei	Palmar. Stroking palm causes closure of fingers.	Forearm and hand, inner half.
I D	Lumbricales and interossei Thenar and hypothenar eminences (C VII-DI)	.....	Upper arm, inner half.
II to XII D . .	Muscles of back and abdomen Erectores spinæ (D I-L V) Intercostals (D I-D XII) Rectus abdominis (D V-D XII) External oblique (D V-XII) Internal oblique (D VII-L I) Transversalis (D VII-LI).	Epigastric. Tickling mammary region causes retraction of epigastrium (D IV-VII). Abdominal. Stroke side of abdomen causes retraction of belly (D IX-XII).	Skin of chest and abdomen in oblique dorso-ventral zones. The nipple lies between the zone of D IV and D V. The umbilicus lies in the field of D X.
I L.....	Lower part of external and internal oblique and transversalis Quadratus lumborum (L I-II) Cremaster Psoas major and minor(?)	Cremasteric. Stroking inner thigh causes retraction of scrotum (L I-II).	Skin over lowest abdominal zone and groin.

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD—CONTINUED.

SEGMENT	STRIPED MUSCLES	REFLEX	SKIN-FIELDS
II L.....	Psoas major and minor Iliacus Pectineus Sartorius (lower part) Flexors of knee (Remak) Adductor longus and brevis	.....	Front of thigh.
III L.....	Sartorius (lower part) Adductors of thigh Quadriceps femoris (L II-L IV) Inner rotators of thigh Abductors of thigh	Patellar tendon. Tapping tendon causes extension of leg. "Knee-jerk"	Front and inner side of thigh.
IV L.....	Flexors of knee (Ferrier) Quadriceps femoris Adductors of thigh Abductors of thigh Extensors of ankle (tibialis anticus) Glutei (medius and minor)	Gluteal. Stroking buttock causes dimpling in fold of buttock (L IV-V).	Mainly inner side of thigh and leg to ankle.
V L.....	Flexors of knee (hamstring muscles) (L IV-S II) Outward rotators of thigh Glutei Flexors of ankle (gastrocnemius and soleus) (L IV-S II) Extensors of toes (L IV-S I) Peronæi	.....	Back of leg and part of foot.
I to II S.....	Flexors of ankle (L V-S II) Long flexor of toes (L V-S II) Peronæi Intrinsic muscles of foot	Foot reflex. Extension of Achilles tendon causes flexion of of ankle (S I-II). Ankle-clonus. Plantar. Tickling sole foot causes flexion of toes or extension of great toe and flexion of others.	Back of thigh, leg, and foot; outer side.
III to V S. ...	Perineal muscles. Levator and sphincter ani (S I-III)	Vesical and anal reflexes.	Skin over sacrum and buttock. Anus. Perinæum. Genitals.

Segmental Skin-Fields

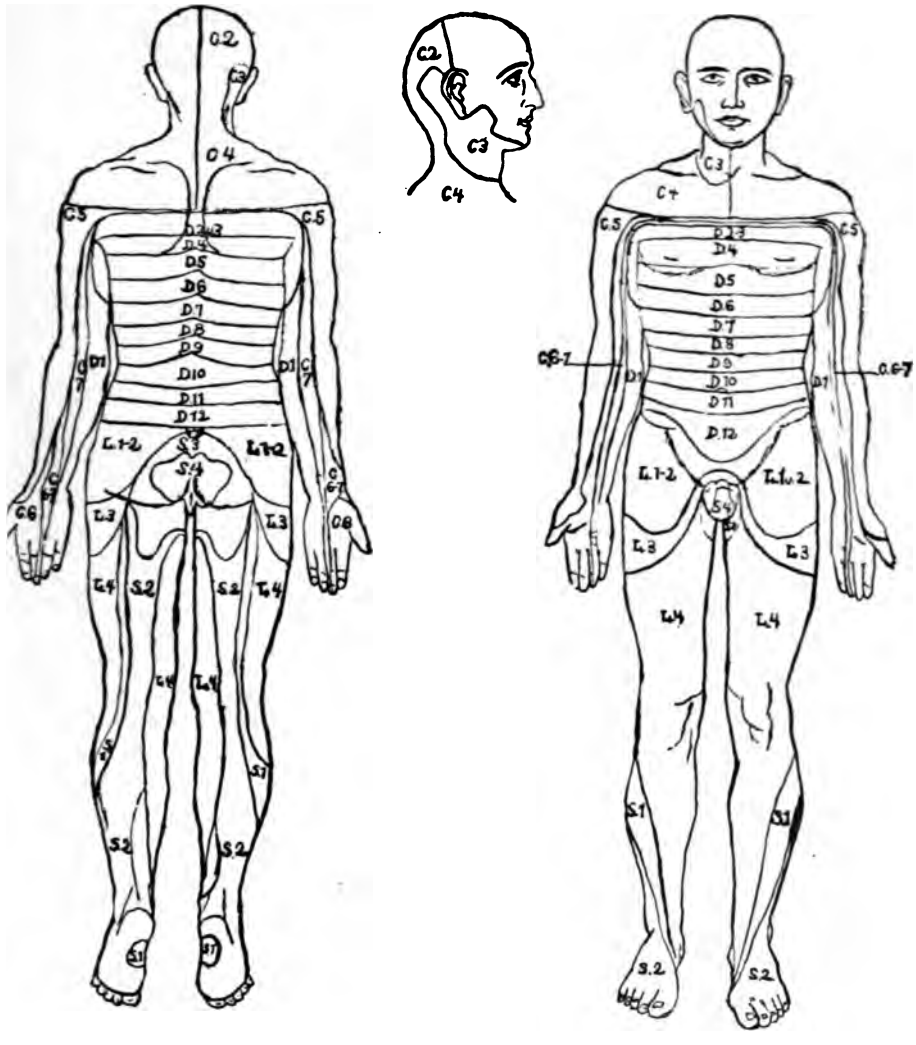


FIG. 15.—Showing the areas on both surfaces of the body which are related to the different segments of the spinal cord. When a segment of the cord is destroyed, the surface of the body is anesthetic in the area corresponding to that segment. C, cervical; D, dorsal or thoracic; L, lumbar; S, sacral.

Fig. 15 shows the segmental skin-fields which assist in determining the segmental level of spinal cord and of dorsal root-lesions.

VISCERO-MOTOR CENTERS.

It will be noted that the following physiologic location of the viscero-motor cells does not correspond with the clinical localization of the viscero-motor reflexes (Fig. 5). However, the former are cited for the sake of completeness. It will also be observed that the clinical evidence tallies with physiologic observation, viz., that there is usually a double viscero-motor mechanism consisting of excitation and inhibition.

TABLE OF THE VISCERO-MOTOR CENTERS.

STRUCTURE.	LOCATION OF VISCERO-MOTOR CELLS.
Pupil (constriction of).	Nucleus of the 3rd cranial nerve.
Pupil (dilatation of).	Between the 6th cervical and 2nd dorsal segments.
Bronchi and bronchioles (constriction of).	Nucleus of the 10th cranial nerve.
Heart (acceleration of).	6th cervical to the 2nd dorsal segments of the cord.
Heart (inhibition of).	Nuclei of the 10th and 11th cranial nerves.
Alimentary canal (accelerating peristaltic movements).	Nucleus of the 10th cranial nerve.
Alimentary canal (inhibition of peristaltic movements).	4th dorsal to the 2nd lumbar segments.
Uterus (inhibition of muscular coat and contraction of the cervix and vagina).	2nd, 3d and 4th lumbar segments.
Dilatation of cervix uteri and vagina.	2nd, 3d and 4th sacral segments.
Bladder (contraction of the sphincter).	2nd, 3d and 4th lumbar segments.
Bladder (relaxation of the sphincter).	2nd, 3d and 4th sacral segments.

Relation of Spines to Segments

By referring to Fig. 10 the physician will be able to determine the relation of the segments of the spinal cord to the spines of the vertebræ. It may be recalled that a segment is called after the pair of nerves which arise from it and not from its vertebral relation. The following table shows the approximate relation of the spines of the vertebræ to the segments of the spinal cord.

APPROXIMATE RELATION OF THE VERTEBRAL SPINES TO THE SPINAL SEGMENTS.

CERVICAL SEGMENTS.	VERTEBRAL SPINES.
I, II	1st *cervical* spinous process.
III, IV	2nd cervical spinous process.
V	3d cervical spinous process.
VI	4th cervical spinous process.
VII, VIII	5th cervical spinous process.
DORSAL SEGMENTS.	
I, II	6th cervical spinous process.
III	7th cervical spinous process.
IV	1st *dorsal* spinous process.
V	2nd dorsal spinous process.
VI	3d dorsal spinous process.
VII	4th dorsal spinous process.
VIII	5th dorsal spinous process.
IX	5th dorsal spinous process.
X	6th dorsal spinous process.
XI	7th dorsal spinous process.
XII	8th dorsal spinous process.
LUMBAR SEGMENTS.	
I	9th dorsal spinous process.
II, III	10th dorsal spinous process.
IV, V	11th dorsal spinous process.
SACRAL SEGMENTS.	
I, II and III, IV and V	12th dorsal spinous process.
COCCYGEAL SEGMENT.	
I	1st *lumbar* spinous process.

The *vaso-motor apparatus* is discussed on page 272.

CHAPTER III.

SYMPTOMATOLOGY.

EXAMINATION OF THE BACK—THE NORMAL SPINE—DISEASES OF THE SPINE—SPONDYLOGRAPHY—EXAMINATION OF THE MUSCLES OF THE BACK—STIFF BACK—MUSCULAR HYPOTONIA—PAIN AND TENDERNESS OF THE SPINE—SYMPATHETIC SENSATIONS—DERMATOMES OF HEAD—VERTEBRAL PAIN—VERTEBRAL TENDERNESS—VERTEBRAL PERCUSSION—VIBROSUPPRESSION.

The VERTEBRAL COLUMN subserves the following objects:

1. It is the central pillar of the body and supports the weight of the head;
2. It connects the upper and lower segments of the trunk and gives attachments to the ribs.
3. It diminishes the effects of shocks conveyed from various parts of the body chiefly by means of its curves and the elastic intervertebral discs which act the part of buffers.*
4. It is endowed with considerable mobility and furnishes a solid tube for the spinal cord.

The MUSCLES of the back and trunk are the only agents in supporting the spine erect. When the muscles in question are exhausted, relief is involuntarily secured by means of rotation and lateral flexion, thus eventuating in the condition known as scoliosis.

THE NORMAL SPINE.

The normal spine must be studied with relation to its CONTOUR and FLEXIBILITY. Any deviation of the spinous

*If the height of an individual is taken in the morning and again at night a decrease in the total height of the body of from 1 to 2 cm. during the day will be noted. This fact may be attributed to compression of the intervertebral discs by the weight of the body in the erect posture.

processes from the median plane of the body may be determined by marking each spinous process with a pencil while the patient stands erect. In the norm the marks represent a straight line. The median line of the body is obtained by holding a plumb-line behind the patient so that the lower end of the line dips into the groove between the buttocks. In the norm each marked spinous process will lie under the plumb-line.

A record may be made by placing crinoline gauze or tracing paper on the back through which the spinal marks may be seen and thus transferring the marks to the gauze or paper.

The contour of the spine may be determined by means of a strip of lead or pure tin thick enough so that it can be molded on the spine and still preserve its shape when removed. The prominent spinous processes should be indicated upon it. The curves of the spine thus obtained may be transferred to paper for further study.

Certain curves are constant, viz.:

1. Forward in the upper;
2. Backward in the middle, and
3. Again forward in the lower region.

These curves are fixed in the adult but may be almost annihilated in early childhood by traction in the horizontal position.

In the erect posture a normal individual will show the following curves (Fig. 16):

1. Cervical, the convexity of which is forward. It begins at the 1st cervical and ends at the 2nd dorsal vertebra;
2. Thoracic or dorsal, the convexity of which is backward. It begins at the 3d dorsal and ends at the

12th dorsal vertebra; its most prominent point behind corresponds to the spine of the 7th dorsal.

3. Lumbar, which is convex anteriorly, commences at the middle of the last dorsal vertebra and ends at the sacro-vertebral angle. This curve is more marked in the female than in the male.
4. Pelvic, which is concave anteriorly, commences at the sacro-vertebral articulation and ends at the point of the coccyx.

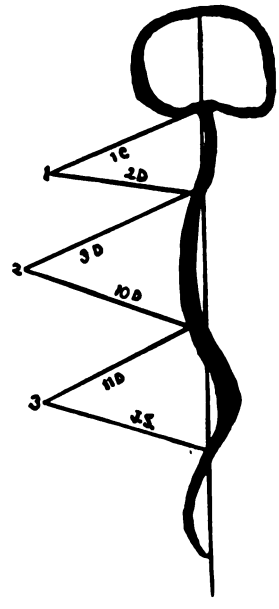


FIG. 16.—Normal vertebral curves and divisions of the spine (Whitman).

The average length of the spinal column in the male is about 2 feet and 4 inches and the female spine is about 2 feet in length. The length of the individual parts is as follows:

1. Cervical..... 5 inches
2. Dorsal.....11 "
3. Lumbar..... 7 "
4. Sacrum and coccyx..... 5 "

In the adult many causes, notably occupations, cause variations of the normal contour of the spine, but in children such variations may be regarded as abnormal.

The normal contour results from balancing of the body in the erect posture, and if there is any variation in one part compensation induces a change in another part, eventuating often in a complete reversal of the normal spinal curves.

Even in the norm there is a slight lateral convex curve to the right, extending from the 5th dorsal to about the 3d lumbar vertebra, which has been attributed to the following causes:

1. Aortic pressure on the vertebral bodies;
2. Excessive use of the right side of the body;
3. Right-handedness.

The FLEXIBILITY of the human spine is largely dependent on movements between the spine and the pelvis and the head.

It is evident that exercises destined for the spine only must presume pelvic fixation, for otherwise, as Lovett[12] puts it, "Part of the muscular force is used in displacing the pelvis to the opposite side to balance the body and the movement becomes a general and not a spinal one."

The MOVEMENTS of the spine are:

1. Flexion;
2. Extension;
3. Lateral flexion;
4. Rotation.

In FLEXION, or forward-bending, if extreme and perfect, the spinous processes will describe the arc of a circle and the distance by measurement from the 7th cervical vertebra to the sacrum is greater than a like measurement secured in the erect or prone posture.

In EXTENSION, or backward-bending, the movement is chiefly limited to the lumbar and the last two dorsal verte-

bræ. In hyperextension, if measurement is made of the distance from the 7th cervical vertebra to the sacrum (over the spinous processes), it is decreased when compared with a like measurement in the erect posture.

LATERAL FLEXION may be tested by side-bending in the erect posture. In the norm the movement is located at and below the lumbar dorsal junction.

ROTATION is most pronounced in the erect posture in the

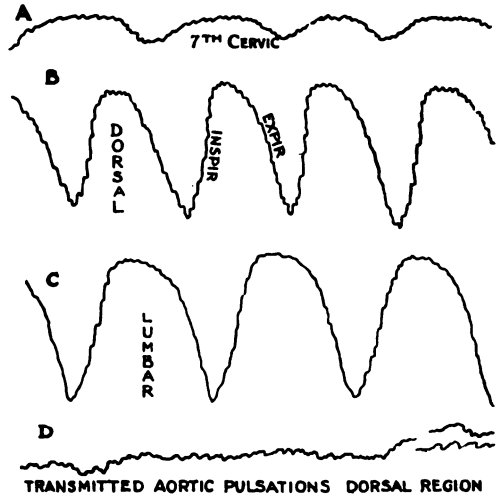


FIG. 17.—Spondylograms reduced one-half. A, taken at the level of the 7th cervical spine; B, taken in the dorsal region; C, taken in the lumbar region; D, transmitted aortic pulsations taken in the dorsal region during the time the patient suspends respiration.

cervical and dorsal regions; the maximum is attained at the top of the cervical column extending below to the lower dorsal region where it is no longer evident.

SPONDYLOGRAPHY.

It is generally contended that the spinal column enjoys a considerable range of motion as a whole, but that the motion between any two individual pieces is extremely

limited. It is known that during deep respiration a straightening of the vertebral column occurs involuntarily. The author has reason to believe that the vertebræ enjoy a greater degree of motion than is usually accepted and to prove this

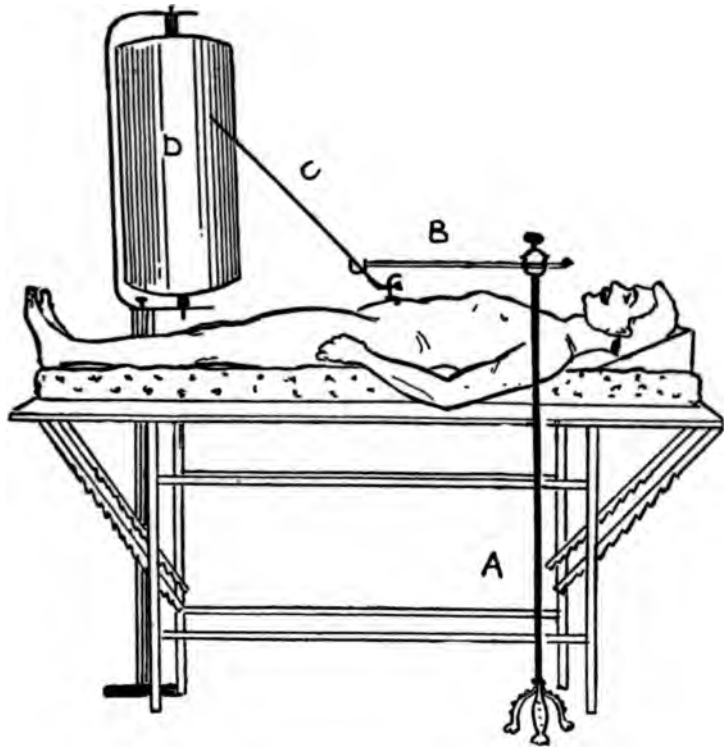


FIG. 18.—Apparatus for taking a spondylogram. The position of the patient is adapted for taking tracings of the abdominal aorta. To take a spondylogram the patient must be in the prone position. A, stand with an adjustable rod, B; C, lever; D, tambour for recording. To the short end of lever (C), a string is passed through an opening and the end of the string is fixed by adhesive plaster to a spinous process.

contention the accompanying spondylograms are submitted (Fig. 17).

They were obtained with the patients in the prone posture during quiet breathing. The serrations noted in

the tracings are probably transmitted aortic pulsations. The apparatus (Fig. 18) employed for eliciting the spondylograms was originally constructed by the author for taking tracings of the abdominal aorta.[32]

Spondylography will aid in the early diagnosis of respiratory vertebral immobility and by furnishing a permanent record, the course of a vertebral disease may be accurately controlled. Here we are in the possession of a method which may be as important to the orthopedist as is the sphygmograph to the clinician.

DISEASES OF THE SPINE.

SPINAL EXAMINATION FOR DEFORMITY.

With the patient in the erect position (heels together and arms hanging) note if the curves are normal or if there is any abrupt projection of one or more spines.

Any ROTATION of the vertebræ may be determined by comparing the prominence of the angles of the ribs, the transverse processes of the lumbar vertebræ, the height and prominence of the scapulæ and the prominence of the iliac crests on the two sides. Estimation of rotation or twist is best determined by Adam's position: The patient bends forwards (with unflexed knees) until the trunk is horizontal with the hands hanging down. With the head on a level with the spine the physician notes whether either side of the trunk is more prominent upward. The presence of an upward prominence indicates rotation or twist. Next, the anterior aspect of the body is inspected and the following noted with reference to the two sides of the body; deformities of the chest and the level of both anterior iliac spines. Again, inspecting the back, the patient is instructed to bend forward (with knees straight) and note should be made if he bends freely and straight forwards. If the movement, however, is

restricted and oblique and if the angles of the ribs are uncovered by the scapulæ and project more on one side, one is dealing with signs of ROTATION OF THE SPINE. The presence and degree of this rotation determine the diagnosis of *Scoliosis* and not, as Gould[13] emphasizes, the lateral deviation of the tips of the spinous processes. Next, the patient assumes the prone posture on a flat couch. In the latter position the following may be noted:

CURVES.	AFFECTION.
Natural curves lost and replaced by a general convexity of the spine backwards altered by movement and disappearing in the recumbent posture.	Spinal muscular debility from rickets or other causes and in convalescents who have maintained the horizontal posture.
The general convexity of the spine backwards is permanent and uninfluenced by movement or the recumbent position and the movements of the spine are diminished.	Spondylitis deformans.
There is an abrupt curve of the spine backwards or several spinous processes are projected posteriorly.	Caries of the spine (Pott's disease).
Diminution of the natural curve in the dorsal region with straight dorsal spine sunk in between the scapulæ and rotation of the spine.	Lateral curvature of the spine (scoliosis).
Lateral deviation of the spines without rotation and disappearance of the deviation in the recumbent position.	Weak-spine often present in hysteria.
A permanent (uninfluenced by position) long sweeping curve to one side without rotation of the vertebræ.	Retraction of chest observed in pleuritis and empyema.

EXAMINATION OF THE MUSCLES OF THE BACK.

"The spine lies at the back of a more or less cylindrical muscular tube of which the abdominal muscles form the front" (Lovett[12]).

There are two kinds of muscles directly attached to the back, one group passing from one part of the spine to another part and to the head and another group running from the spine to the pelvis or shoulder girdle.

In diagnosis and in treatment by *muscular exercises*, the fact must be emphasized that the spinal movements are not affected by an individual muscle but by all the spinal muscles which act in unison.

The relative rigidity of the thoracic spine is dependent on the attachment of the ribs behind, between two vertebræ and to the sternum in front.

There are two feeble and movable parts of the spine (points where important muscles have a dividing line), viz.:

1. At the cervico-dorsal junction;
2. At the dorsolumbar junction.

The ligaments of the spine are loose and the surfaces of the articular processes are only in slight contact, hence the muscles of the back and trunk are the only agents for maintaining the spine erect. The moment the muscles are exhausted some relief is obtained by rotation and lateral flexion of the spinal column (which tightens the ligaments and brings the articular processes in closer contact) which eventuates in scoliosis.

RIGIDITY OF THE SPINAL MUSCLES.

The condition of the spinal muscles may be determined by the movements of the patient and by palpation. The

former may be tested by directing the subject to jump, run, walk, pick up objects from the floor, etc.

The tests must include movements which necessitate flexion, extension and lateral bending of the spine.

By placing the palm of the hand on various parts of the spine and then directing the patient to make different motions, one may note during execution of the latter whether the vertebræ move or are fixed.

Special movements exclude definite joint-involvement.

Free and painless nodding of the head excludes implication of the occipito-atloid joint.

If the face can be easily turned from one side to another the atlo-axoid joint is not involved.

The lower cervical spine is not implicated if flexion of the head can be executed freely and painlessly.

The various voluntary movements must be adapted to the intelligence of the patient. Thus children who resist passive movements on a table will submit to manipulation in the arms of the mother.

A child will walk toward its mother and will incline the head in the direction of the latter—a useful test in determining the condition of the cervical spine.

By placing the patient in a recumbent position (with head slightly elevated), first on the right and then on the left side, the spinal muscles are relaxed and may be carefully palpated.

In the norm the muscles show no tenderness, are elastic and easily roll under the palpating finger.

SPASM OF THE SPINAL MUSCLE.

By the term "*spasm*," one refers to an abnormal muscular contraction due to an augmented reaction of the motor nerves. When the muscular contraction is prolonged it is known as

a tonic spasm, in contradistinction to a clonic spasm, in which contractions of brief duration alternate with flaccid conditions of the muscle.

Spasm of the spinal musculature such as the author conceives the condition must be dissociated by the reader from the conventional twitchings and spasmodic movements of individual muscles or groups of muscles.

It is true that, the clinician has long recognized the almost intelligent function of muscles whether displayed in fixing a diseased joint or spine, or in protecting an inflamed serous membrane, but he has neglected to carefully palpate the spinal musculature for localized spasms which are usually tonic in character.

To detect such muscular contractions the patient must be placed on a table in the lateral posture to secure muscular relaxation.

The investigations of the author show that pressure at the vertebral exits of the spinal nerves will elicit muscular contractions in definite regions, and conversely, that pressure in the latter situations will evoke localized clonic or tonic spasm in definite spinal regions.

In disease the peripheral localized spasm may be present independent of the spinal spasm, but, as a rule, careful palpation of the spinal and peripheral musculature demonstrates that they coexist.

In the accompanying illustration (Fig. 19), the author has endeavored to present a composite picture as obtained in the norm.

The illustration shows the vertebral area involved in spasm during the time firm pressure is made in definite peripheral regions. Pressure made at these vertebral exits will provoke spasm of the peripheral musculature. The vertebral areas are only approximately correct insomuch as the

spasm of the spinal musculature is often diffused and exact localization is often impossible. The palpating finger may only feel a tremor or a sensation like a pulsation in the muscle. Not infrequently the contraction of the spinal muscle may be seen.

It will be noted that although pressure is only made on

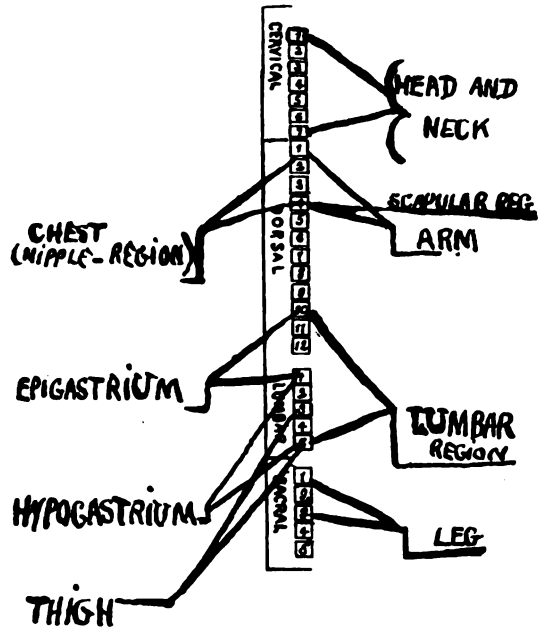


FIG. 19.—Vertebral areas involved in muscular spasm when different peripheral regions are firmly compressed or irritated.

one side of the spinal column the muscular contraction is often bilateral. If deep and firm pressure with the fingers of one hand is made on any of the peripheral points of spasm, the other hand will usually detect bilateral localized spasm of the spinal musculature corresponding to the vertebral areas indicated in Fig. 19.

While mere cutaneous irritation will induce contraction

of the spinal muscles, the latter is less evident than when deep pressure is made on the peripheral muscles or when the peripheral area is painful. The recognition of these peripheral and spinal spasms is destined to be of considerable value in diagnosis.

Space will not permit the author to descant further on this subject, but he may be permitted to cite *meningismus* as a paradigm.

The latter affection occurs in association with suppurative diseases of the middle ear in children and adults and symptoms are present (notably rigidity of the neck-muscles) which simulate disease of the brain although no intracranial inflammation exists.

If the peripheral source of irritation can be inhibited by means of cocain, the rigidity of the neck-muscles will subside temporarily. Reference to the accompanying illustration (Fig. 20) shows the extensive anastomoses of the cervical plexus and explains the frequency (when sought) of rigidity of the neck muscles in affections of the head and face.

There must also be a spasm of the spinal musculature as an expression of visceral disease and this is a subject worthy of investigation.

At present, however, we must rely on vertebral tenderness and the dermatomes of Head as indices of visceral disease (page 58).

STIFF BACK.

Stiffness and lack of mobility of the back may be caused by:

1. Pain (lumbago, vertebral disease, tonic spasm of the muscles);
2. Ankylosis of the vertebral column.

MUSCULAR RIGIDITY is one of the earliest signs of Pott's disease and persists until cure is effected. It is most pro-

Cervical Plexus

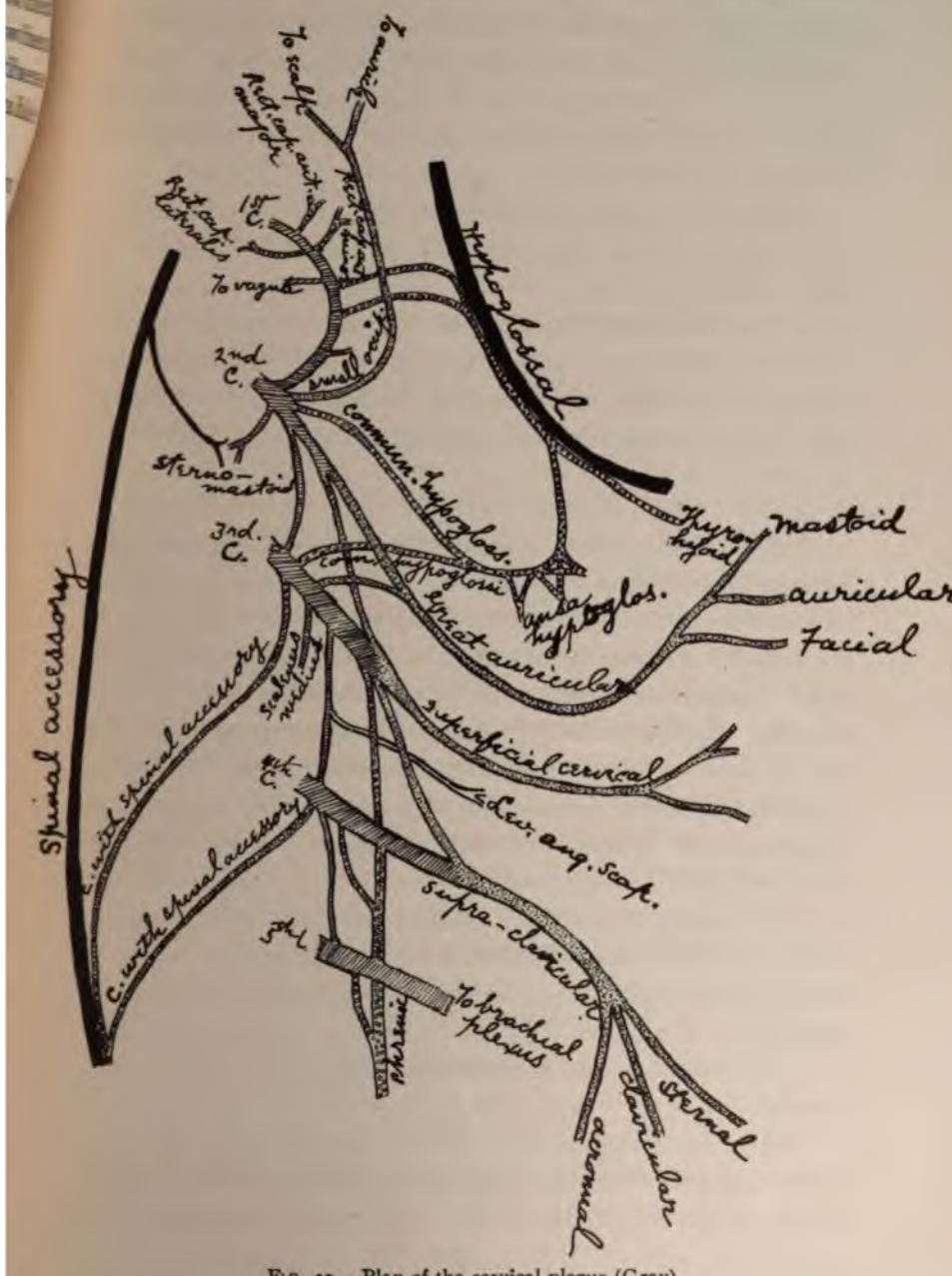


FIG. 20.—Plan of the cervical plexus (Gray).

nounced in the neighborhood of the disease, but may extend some distance. If the patient is directed to bend forward and no rigidity nor spasm is associated with the movement and the outline of the spinal curve is even and not broken, Pott's disease may be safely excluded.

Muscular rigidity dissociated with spinal disease resists motion only in the directions directly opposed by the contraction of the muscles. If the spasm, however, is associated with spinal disease it resists motion in all directions.

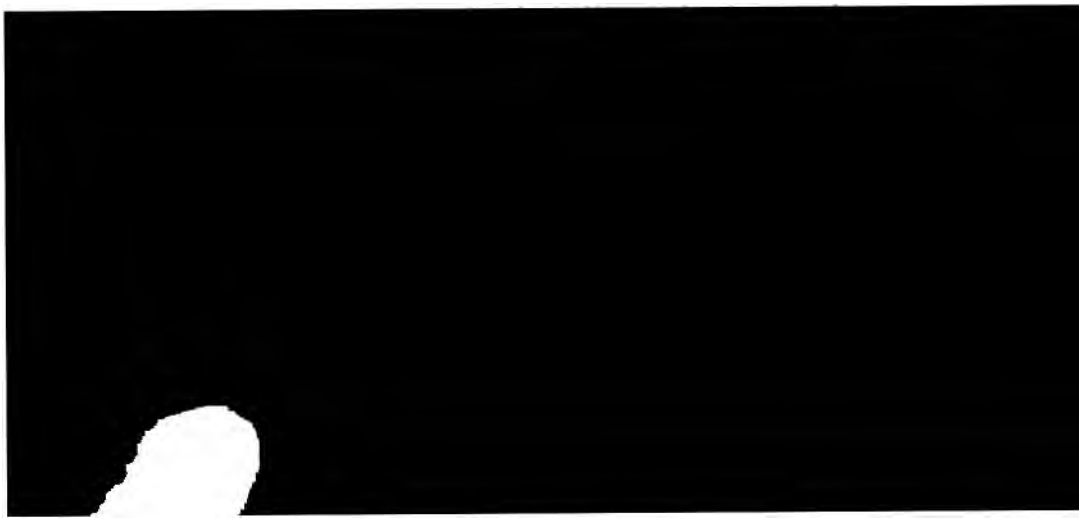
A stiff back due to ankylosis of the vertebral column may be caused by any of the following diseases (*q. v.*): Spondylitis, Pott's disease, paralysis agitans and arthritis deformans.

MUSCULAR HYPOTONIA.

Muscular fatigue is an invariable sign of neurasthenia. Fatigue of muscle is caused essentially by the consumption of material necessary for contraction and the storing up in the muscle of waste products produced by its own activity. Some people tire more easily than others, owing to the fact that the waste-products responsible for the fatigue in the one are less readily removed or accumulate more easily.

Massage of the muscles rapidly removes the evidence of fatigue simply because the waste products are washed into the circulation by this manœuver.

The fatigue in neurasthenia probably has its origin in the



act of volition rather than by that of the muscles themselves. The very moment these centers are exhausted the contraction of the muscle gives way.

Volition can be fatigued when exerted in imagination as well as in actual muscle-effort.

BACKACHE, or a sensation of weariness, is a frequent symptom of neurasthenia and the older writers referred to this sign as spinal irritation (*vide* neurotic spine). It is known that when fatigue-signs are exaggerated they become painful and are described as "aches."

Many cases of backache in neurasthenics are caused by a faulty spinal attitude. Thus the attitude of children with round shoulders (page 96) will substitute ligamentous for muscular support. All our muscular groups are not equally and symmetrically developed and many deformities such as spinal curvatures, round shoulders, etc., bear witness to the truth of the foregoing statement (*vide* Exercises).

Decrease in the normal tone or elasticity of the muscles is designated by the word HYPOTONIA, and this condition is frequent in many nervous diseases.

It is difficult to measure muscular-force. The dynamometer and the ergograph yield valuable but inconstant information.

The muscles may be tested by noting the strength of the Galvanic current (read in milliampères) and Faradic current (measurement on the scale of the secondary spiral and expressed in millimeters of coil-distance) necessary to produce the minimal contraction.

The muscles of the healthy side may be used as a standard of comparison, otherwise we must be governed by the reactions observed in the average individual with normal musculature.

One notes that when the muscles are weak, with the strongest current the contraction of the muscles may be no greater than with weak currents.

The implicated muscles do not contract *in toto*, but only a few bundles contract and appear as slightly prominent ridges.

The Faradic current provokes no tetany, but only several clonic contractions of the muscle-substance which succeed each other during the closure of the current (myoclonic contractions).

For strengthening defective spinal muscles the sinusoidal current (page 151) is very effective.

Very frequently individual muscle-groups are involved in hypotonia. Thus a faulty position of the scapulæ may be caused by the muscles which maintain the position of the latter. Similarly, scoliosis may be provoked by an hereditary hypotonia of the spinal muscles.

A lack of tone or relaxation of the muscles is an early sign[14] of LOCOMOTOR ATAXIA. This hypotonia may be estimated as follows: With the patient in the erect position the distance from the floor to the greater trochanter and the 7th cervical vertebra is measured. If the patient is now instructed to bend forward (knees stiff) as far as possible and the distance in this position is again estimated from the floor to the 7th cervical vertebra, it will be found that in health, and in all affections (excepting tabes), it is impossible to bend the trunk sufficiently forward to permit the 7th cervical vertebra to be brought to or below the level of the trochanter. The hypotonia of the muscles in tabes, however, permits the vertebra in question to attain a distance of 21 or more cm. below the level of the trochanter.

PAIN.

Pain results from powerful stimulation of a nerve, and in accordance with the law of eccentric projection, it is a matter of little moment which part of the nerve is stimulated, the perception of pain being referred to the periphery.

According to the prevailing hypothesis pain-perception is the result of individual stimulations which accumulate probably in the cells in the posterior part of the gray substance of the spinal cord and it is the total of such stimulations which eventuates in a discharge which the patient interprets as pain.

The intensity of the pain is determined by the duration and amount of the stimulation and by the irritability of the nerve-fibers and ganglion-cells.

The expression of pain is no measure of its intensity. Animals as well as men show differences in their sensitiveness to pain. A frequent clinical error is to underestimate the intensity of pain and to question its reality simply because by diverting the attention of the patient the latter exhibits less evidence of his suffering.

Pain is usually worse at night for the very evident reason that in the daytime our attention is distracted.

It is also evident that the imagination of pain will accentuate its intensity. In estimating pain objectively the personal equation must always be taken into consideration, and by aid of the following method[45] one may determine the degree to which an individual is sensitive to pain. With the thumb, pressure is made over the styloid process in the neck. Some patients will complain of the slightest pressure, whereas others will tolerate considerable pressure without a pain-reaction (*vide* vertebral tenderness on page 71).

REFLEX PAINS.

As a rule the site of pain corresponds to the location of the lesion. In other instances peripheral pains may be caused by diseases of the spinal cord. Reflex or transferred

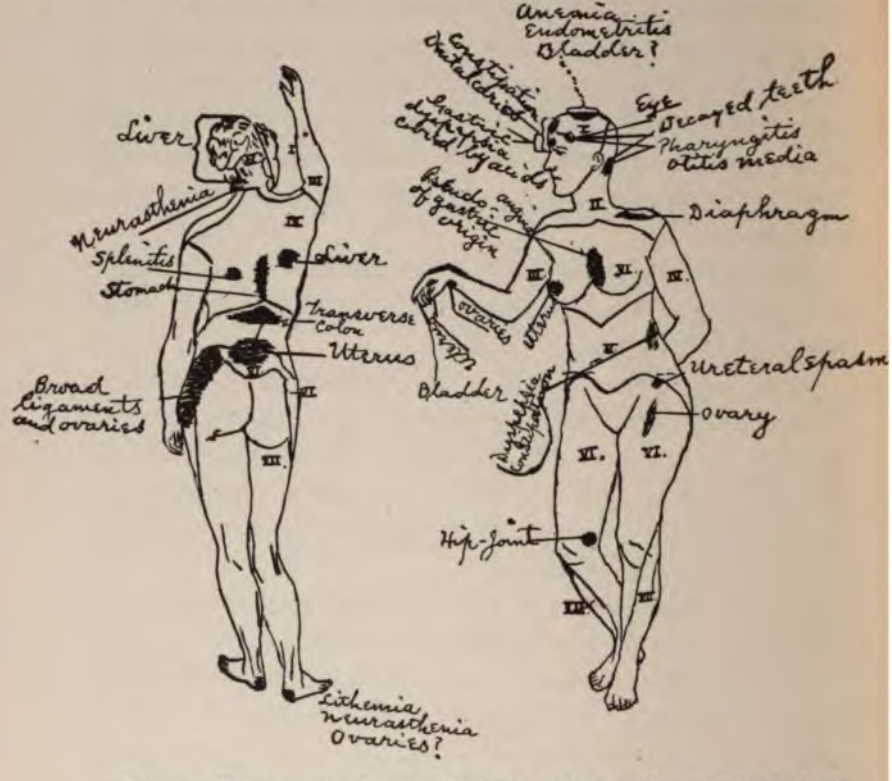


FIG. 21.—Diagrams showing the distribution of the cerebro-spinal strands of nerves and the location of transferred pains and neuralgia.

pains may be caused by an irritation at the origin of the nerve-trunk and the pain may be referred to its peripheral distribution.

The illustrations of Dana (Fig. 21) show the usual location of transferred pains.

Dana observed that the sensory nerves of these areas

were correlated with the sympathetic ganglia innervating the areas in question.

SYMPATHETIC SENSATIONS.

Quincke has collected a number of sympathetic sensations associated with a circumscribed hyperalgesia of the skin, and one is constrained to conclude that the skin-areas are supplied by the same nerves as the organs.

According to Donaldson the splitting nerve-fiber sends one portion to the organ and one to the skin overlying it.

A pertinent illustration of cutaneous hyperalgesia is observed in affections of the heart when pressure of the skin over the heart-region elicits sensitiveness.

As a rule the skin overlying an organ is associated with it reflexly, and it is for this reason that one can explain how percutaneous therapeutic methods may influence visceral disease.

SYMPATHETIC SENSATIONS.

AFFECTION.	SYMPATHETIC SENSATIONS.
Disease of the middle-ear and mastoid process.	Parietal pains.
Disease of the frontal sinus.	Trigeminal pains.
Irritation of the posterior wall of the auditory canal.	Tendency to cough (irradiation from the auricular branch of the vagus).
Pulmonary abscess (percussion of).	Pain in the larynx.
Angina pectoris.	Pain in the left arm.
Diseases of the stomach.	Pain in the back.
Intestinal worms.	Tickling in the nose.
Diseases of the liver.	Pains in the shoulder.
Diseases of the spleen.	Pains in the left shoulder.
Diseases of the bladder.	Pains in the genitalia and lumbar region.
Diseases of the uterus.	Pain in the epigastrium.
Coxitis.	Pain in the knee.

DERMATOMES OF HEAD.

While cutaneous pains are usually projected with great accuracy to the point stimulated, pain originating in the internal organs is located very inaccurately.

Head[46] and others have demonstrated that the different visceral organs bear a definite relation to certain areas of the skin, in other words, in visceral disease,* pain and disturbed sensation may be referred to definite cutaneous areas. Thus one may have a cutaneous expression of visceral disease

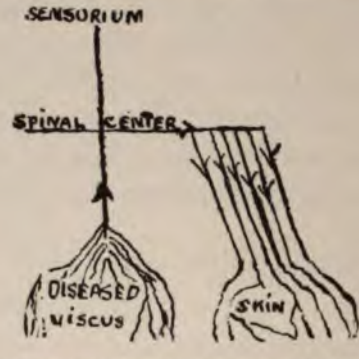


FIG. 22.—Illustrating cutaneous tenderness and the radiation of pain in visceral disease.

which I may call an *endogenetic skin reflex*. The cutaneous tenderness in visceral disease is explained as follows: When a stimulus is applied to an organ or tissue with diminished sensibility and which is centrally connected with an organ or tissue with a higher degree of sensibility, pain is referred to the organ or tissue which is relatively more sensitive.

Reference to Fig. 22 will elucidate this matter.

*Kast and Meltzer,[15] found in animal experimentation that the sense of pain is present in normal organs, and that it is considerably augmented in inflamed organs, and that a subcutaneous or intramuscular injection of cocain is capable of completely abolishing the sensation in normal as well as in inflamed organs. They suggest that the anesthesia of the abdominal organs observed by some surgeons was due to the use of cocain.

If the viscus is irritated, say as the result of inflammation, sensory impulses which are usually below the threshold of consciousness are conveyed to its sensory center or segment in the spinal cord. Now to the same segment is also connected a definite area of skin from which sensory impressions are habitually received, hence the sensations in consciousness are not referred to their true visceral origin but to the surface of the body.

Now Head found that in many visceral diseases, if the sensitiveness of the skin were tested by running a pin point over the cutaneous surface, definite areas could be demonstrated showing hypersensitiveness (hyperalgesia) to pain. Such areas on the surface of the body are known as skin-units or *dermatomes*. The latter correspond to the spinal segments, from which the posterior roots take their origin and not to their peripheral distribution.

The dermatomes are hypersensitive to heat and cold, but not to touch. Head concluded that when the dermatomes could be demonstrated they invariably indicated an affection of the organ to which they corresponded. The dermatomes or zones of hyperalgesia appear early and continue throughout the course of a visceral disease. If absent, say in appendicitis, they appear after palpation of the appendix. The author has found that if the zones are present they are practically always exaggerated after manipulation of a given organ.

As a rule the disappearance of a zone is associated with relief of a diseased organ. If, however, the symptoms increase or persist, the sudden disappearance of a zone is a sign of ill-omen.[45]

There is no definite relation between the severity of the visceral lesion and the degree of cutaneous hyperalgesia. The absence of a zone does not exclude a lesion of a given

organ, but, if demonstrated, it is corroborative evidence that such a lesion is present.

It is important to remember that counterirritation over a zone of hyperalgesia is often surprisingly efficient in relieving the pain and underlying condition of the visceral disease.

The application of cold to the abdomen in acute abdominal affections owing to the anesthesia produced is equally efficient.

On the same theory Elsberg and Neuhof,[45] secure relief from pain in acute affections by anesthetizing the hyperalgesic area with menthol (50 per cent).

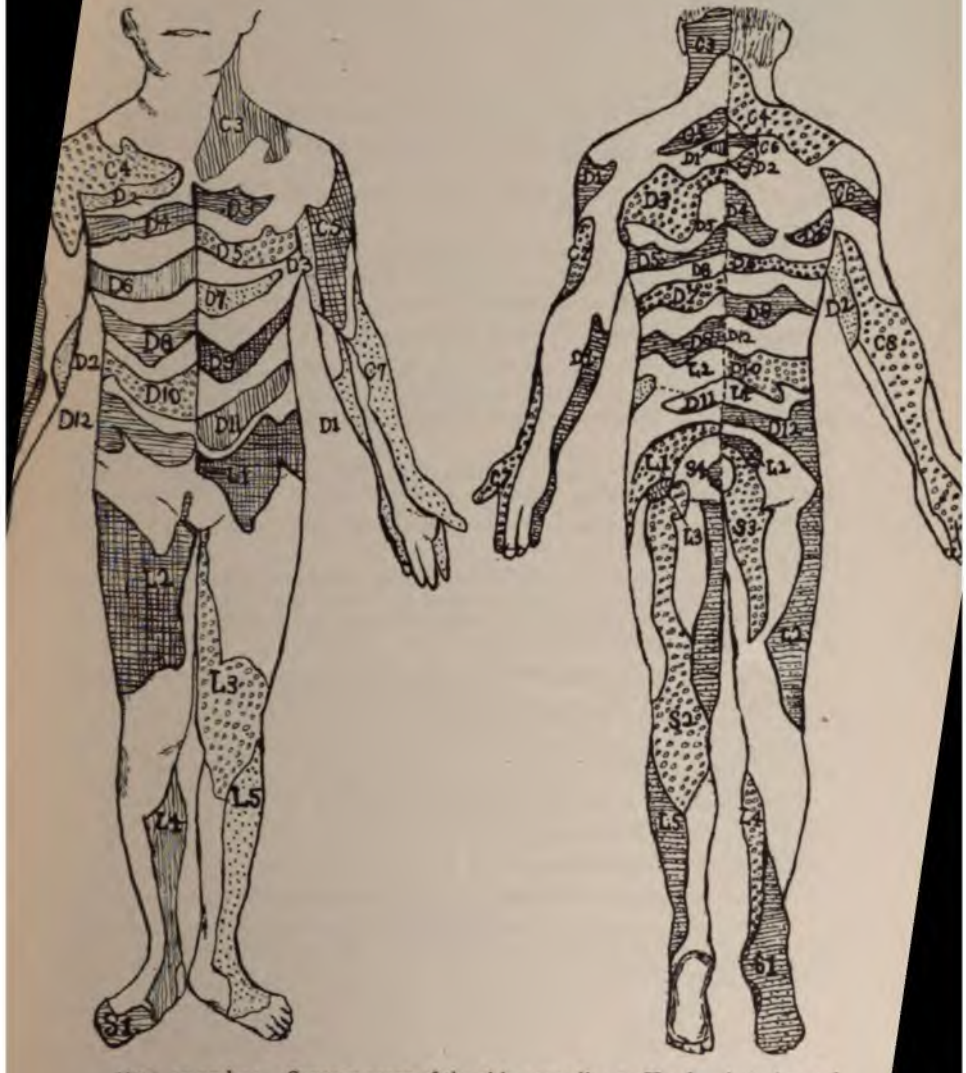
Reference to Figs. 23, 24, 25 and 26 shows, according to Head and Schmidt,[47] the segmental distribution of referred pain and cutaneous tenderness in visceral disease, and Fig. 27 shows the associated painful areas about the head related to visceral disease and areas of referred pain and tenderness in affections of the head and neck.

METHODS FOR ELICITING THE DERMATOMES.

Head tested the skin sensitiveness to pain by pinching up folds of skin or by stroking the skin with the point of a sharp pin.

I often employ the vibrations of a tuning-fork for demonstrating the zones and the vibration-sensation may either be increased (hyperalgesia) or diminished (hypalgesia).

The method of Elsberg and Neuhof[45] is as follows: A sharp pin is held between the thumb and index finger of the the right hand, the nail of the index finger resting on the patient's skin. The pin is then made to traverse slowly the surface of the skin, care being taken that the nail of the index finger presses equally along the area examined. The patient must say "now" the moment the stroke of the pin becomes painful.



FIGS. 23 and 24.—Sensory areas of the skin according to Head. Anterior and posterior views. C, cervical; D, dorsal; L, lumbar segments of the cord. Further description of these and subsequent figures on page 62.

SEGMENTAL DISTRIBUTION OF REFERRED PAIN AND TENDERNESS IN VISCERAL DISEASE.

SEE FIGS. 23, 24, 25 AND 26.

Heart.—Third cervical and first, second and third dorsal segments.

Lungs.—Third and fourth cervical and first to ninth (sometimes tenth) dorsal segments, especially the third, fourth and fifth.

Breast.—Fourth and fifth dorsal segments.

Esophagus.—Fifth, sixth and eighth dorsal segments.

Stomach.—Third and fourth cervical and sixth, seventh, eighth and ninth dorsal segments. Cardiac end from the sixth and seventh and the pyloric end from the ninth.

Intestines.—Down to the upper part of the rectum: Ninth, tenth, eleventh and twelfth dorsal segments. Rectum: Second, third and fourth sacral segments.

Liver and Gall-bladder.—Seventh, eighth, ninth and tenth dorsal segments and perhaps the sixth.

Kidney and Ureter.—Tenth, eleventh and twelfth dorsal segments. The nearer the lesion lies to the kidney the more is the pain and tenderness associated with the tenth dorsal segment. The lower the lesion in the ureter the more does the first lumbar segment tend to appear.

Bladder.—Mucous membrane and neck of the bladder: First, second, third and fourth sacral segments. Over-distention and ineffectual contraction: Eleventh and twelfth dorsal and first lumbar segments.

Prostate.—Tenth, eleventh and twelfth dorsal, first, second and third sacral and third lumbar segments.

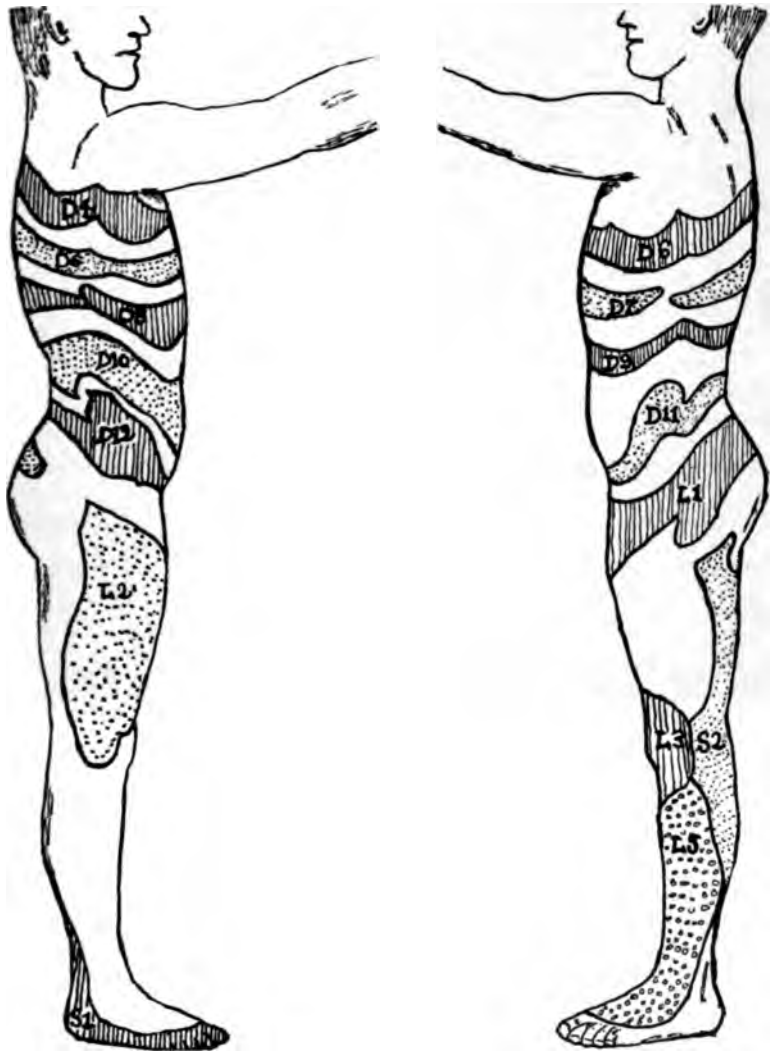
Epididymis.—Eleventh and twelfth dorsal and first lumbar segments.

Testis.—Tenth dorsal segment.

Ovary.—Tenth dorsal segment.

Uterine Appendages.—Eleventh and twelfth dorsal and first lumbar segments.

Uterus.—In contraction: Tenth, eleventh and twelfth dorsal and first lumbar segments. Os uteri: First, second, third and fourth sacral segments, and very rarely, the fifth lumbar.



FIGS. 25 and 26.—Sensory areas of the skin according to Head.

ASSOCIATED PAINFUL AREAS ABOUT THE HEAD RELATED TO VISCERAL DISEASE.

SEE FIG. 27.

AREA ON BODY.	ASSOCIATED AREA ON HEAD.	ORGANS IN PARTICULAR RELATION WITH THESE AREAS.
Cervical 3 and 4	Fronto-nasal	Apices of lungs, stomach, liver, aortic orifice (?).
Dorsal 2 and 3	Mid-orbital	Lung, heart, arch of the aorta.
Dorsal 4	Doubtful	Lung.
Dorsal 5	Fronto-temporal	Lung and occasionally the heart.
Dorsal 6	Fronto-temporal	Lower lobe of lung and heart.
Dorsal 7	Temporal	Bases of lungs, heart and stomach.
Dorsal 8	Vertical	Stomach, liver and upper part of the small intestine.
Dorsal 9	Parietal	Stomach and upper part of the small intestine.
Dorsal 10	Occipital	Liver, intestine, ovary and testicle.

AREAS OF REFERRED PAIN AND TENDERNESS IN AFFECTIONS OF THE HEAD AND NECK.

SEE FIG. 27.

ORGAN INVOLVED.	MAXIMUM POINT OF REFERRED PAIN AND TENDERNESS.	ORGAN INVOLVED.	MAXIMUM POINT OF REFERRED PAIN AND TENDERNESS.
Ciliary muscle (Disorders of accommodation)	Mid-orbital	Upper teeth	Frontonasal, nasolabial, temporal, maxillary, or mandibular.
Cornea	Frontonasal	Lower teeth	Mental, hyoid, superior laryngeal and in the ear.
Iris	Fronto-temporal, temporal, and maxillary	Tongue, anterior part	Mental.
Vitreous body (Glaucoma)	Temporal	Tongue, lateral part	Hyoid, superior laryngeal and in the ear.
Retina	Vertical	Tongue, posterior part	Superior laryngeal, hyoid, occipital.
Tympanic membrane	Hyoid	Tonsil	Hyoid and in the ear.
Middle ear	Vertical and behind the ear	Nose, olfactory portion	Frontonasal and mid-orbital.
		Nose, respiratory portion and posterior nares	Nasolabial (occasionally).
		Larynx	Superior and inferior laryngeal (in destructive lesions).

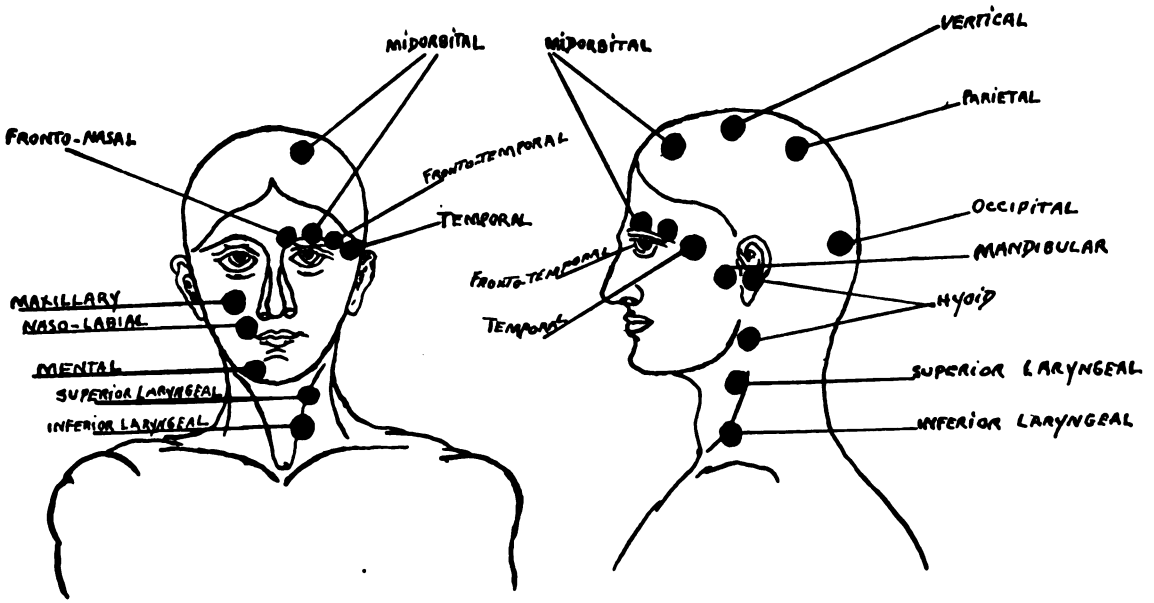


FIG. 27.—Painful areas about the head related to visceral disease and areas of referred pain and tenderness in affections of the head and neck. Further description on page 64.

Not infrequently, if the hyperalgesia is pronounced, the patient will scream as soon as the border of the zone is reached. Young children cannot give correct answers, hence with them this method is useless. The zones of hyperalgesia extend from the median line in front to the spines behind.

In Figs. 28 and 29 (Elsberg and Neuhof), the maximum areas of sensitiveness within the boundaries of a zone are deeply shaded.

VERTEBRAL PAIN.

This symptom may be determined in a variety of ways:

1. By pressure of the vertebral spines with the fingers or by percussion of the spines by means of the plexor and pleximeter (Fig. 2). The latter method is preferable. Very frequently no pain is elicited when a vertebral spine is pressed downward, yet, when the spine is pushed to one side or lifted, sensitiveness can be demonstrated.

2. By pressure alongside of the spine at points corresponding to the exit of the spinal nerves.

3. By pressure vertically down through the spine made on the head and again on the shoulders.

4. By firm pressure on the transverse processes so as to rotate the individual vertebræ and thus determine implication of the joints.

5. By aid of the hot-sponge test, which consists of passing down the spine a sponge wrung out in warm water. The latter must only be sufficiently warm so as not to be unpleasant to the healthy skin. In definite affections, notably *myelitis*, pain is experienced by the patient when the sponge passes over the site of the disease.

6. By testing pain-susceptibility (pallesthesia). In the norm, if a C (130 vibrations) or an A (440 vibrations)

tuning-fork is placed on any of the vertebral spines, a trembling or whizzing sensation is perceived. The skin, as well as the bone, participates in the perception of the vibrations. Sensation is diminished or lost (bone-anesthesia) in the ataxic stage of tabes. Bone-sensibility may be increased in

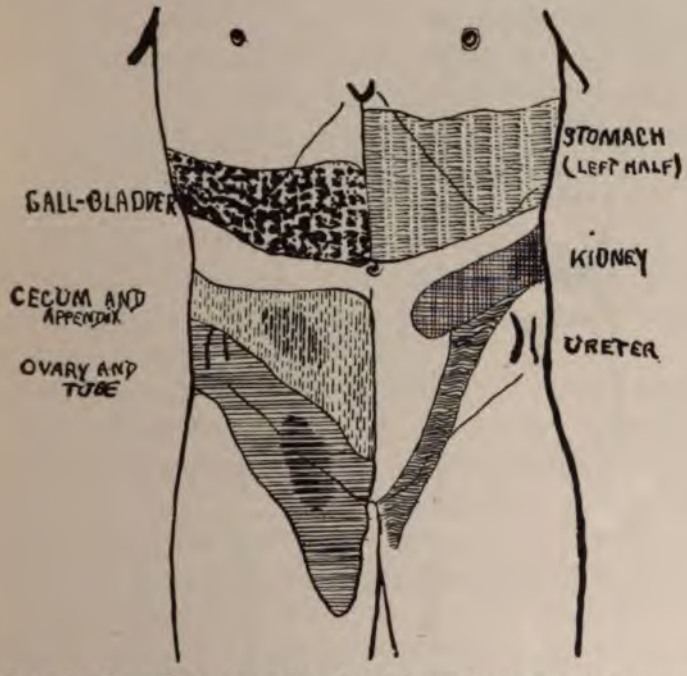


FIG. 28.—General location and outline of hyperalgesic zones for some of the abdominal organs. Anterior view. The maxima are deeply shaded.

incipient tabes and the vibrations of the fork produce a burning as well as the whizzing sensation.

Bone-sensibility is also altered in other nervous affections, thus in *hysteria*, the application of the fork is followed by the sudden disappearance of sensibility of the bone and skin.

If the vertebræ or corresponding spinal nerve-roots are

sensitive, the vibrations of the tuning-fork are more keenly appreciated by the patient.

7. By finding painful centers.[40] For this purpose the patient's back is bared and a high tension Faradic coil is brought into use. Before applying this current the coil

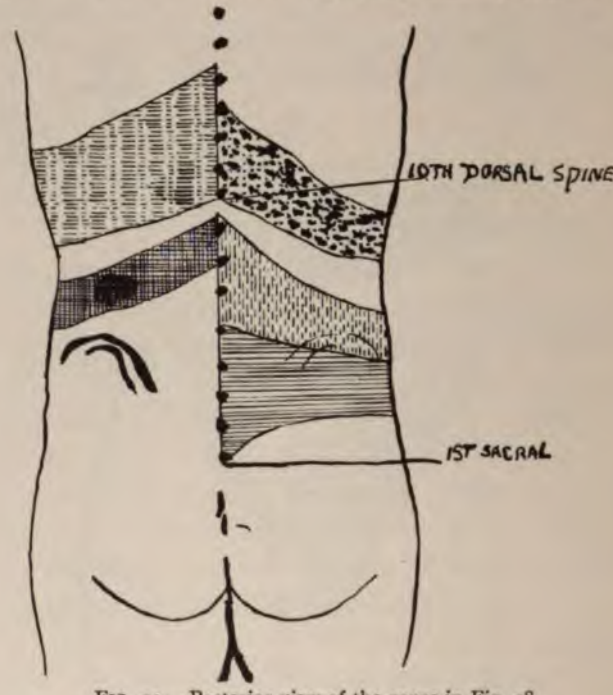


FIG. 29.—Posterior view of the zones in Fig. 28.

should be tested with a four-to-six inch Geissler tube. If the coil is capable of illuminating the tube, then it possesses the proper amount of penetrative power. For this diagnostic work the Kidder Manufacturing Company of New York make a special coil. One pole of the battery (it does not make any difference which) is attached to the 6 x 6 inch moist electrode and placed in front over the epigastric plexus. The other electrode (2 x 2 inches), well moistened, is passed

lightly over the spinal column with a current-strength sufficient to be agreeably susceptible. This current is passed up and down the entire length of the spinal column with ordinary pressure eight or ten times and the electrodes removed when one will note vivid *red spots* on a white background. The latter become more prominent several minutes after the current is removed. Digital pressure upon these spots will elicit sensitiveness, whereas no pain will be complained of in the intermediate region.

These spots are pathognomonic of certain ailments and the clinician can almost make a diagnosis from the reflex centers involved.

8. Very frequently, if one pole of a Galvanic current (with the other electrode at an indifferent point) is passed along the spine, no appreciable sensation is felt until a sensitive area is attained.

9. It is known that many patients suffer from pains in the head and chest when exposed to draughts. The latter may be substituted by a current of cold air from an air-pump, which, when directed at the vertebral exits of the affected nerves, will reproduce the pains from which the patient suffers. Very often the pain is also reproduced when the air is directed on the site of the reflected pains.

Other methods for the elicitation of vertebral tenderness are described on page 72.

Having located by any of the foregoing methods the area of tenderness, it is well to employ some mark for future reference in treatment. For this purpose a stick of nitrate of silver, slightly moistened, may be used as a pencil, thus leaving a line which cannot be effaced. If one desires to remove the stain of the latter, apply a drop of tincture of iodine and then ammonia, or use potassium iodid solution.

DEDUCTIONS RESPECTING VERTEBRAL PAIN.

For the objective elicitation of pain, one must exclude cutaneous hyperesthesia, which is a dominant factor in the so-called *hysterical spine* and which is present in many neuroses. Here, when the skin is lightly touched or pinched without any pressure on the bone, pain is experienced. If the patient's attention is diverted the identical spot may be touched without eliciting any pain. Friction of the tender area with a rough fabric of cotton to induce irritation of the skin is often followed by disappearance of the painful areas.

Tenderness of the vertebræ, rather than pain, is rarely absent in neurasthenia and sensitive areas may be demonstrated in the latter affection as well as in hysteria.

These TOPOALGIAS may not disappear until treatment is directed to the general condition.

Topoalgia limited to the vertebral column is known as *rachialgia*. In the hysterical spine there is usually a history of traumatism and it must be recalled that hysteria long latent and unrecognized may be awakened into obvious activity by a blow or accident.

To determine whether a given sensitive area is real or simulated, the following signs may be employed:

1. Mannkopff's sign.—Take the pulse-rate before, during, and after pressure is made on the sensitive area. If the pulse becomes increased in frequency it is a proof that the pain is genuine.

2. Sign of Lœwi.—Dilatation of the pupil is in direct proportion to the intensity of the pain. Thus, if in a healthy man one exercises energetic pressure on the testicle, the pupil dilates, whereas in the tabetic in whom the testicle is insensitive, no pupillary dilatation is observable.

3. In neuroses the spine is not rigid at the points of sensitiveness.

In diagnosis one must look for other symptoms suggestive of a neurosis.

In children radiating pains dependent on vertebral disease are frequently misinterpreted, as headache, cough or stomachache.

In Pott's disease reflex muscular spasm is associated with pain. In disease of the cervical region the head is held stiffly or is supported with the hands.

In disease of the dorsal region the pain may radiate to the chest, respiration may be groaning and night cries occur.

In lumbar disease the pain is referred to the legs or lower abdominal region. In Pott's disease there may be absolutely no local pain on pressure, but spasm of the spinal muscles, especially on an attempted movement, is practically always present and is an early sign.

Angular deformity of the spine is a late manifestation of the disease.

Pains due to other causes are discussed later.

VERTEBRAL TENDERNESS.

The elicitation of the dermatomes of Head is a tedious method of examination and not always accompanied by satisfactory results for the reason that a great amount of experience is necessary. Alsberg[16] in the examination of 200 women (with gynecological affections) found cutaneous areas of hyperalgesia in only seventeen, ten of whom were hysterical. Therefore, he could attribute no diagnostic import to the zones in question beyond commenting on the fact that hysterical stigmata must be excluded before the zones of hyperalgesia could be regarded as trustworthy.

There is no longer any doubt concerning the fact that

spinal tenderness corresponding to different segments of the spinal cord is associated with visceral disease. To attain definitiveness of localization, however, it is necessary to carefully examine the vertebræ by percussion (page 66), or by palpation; place the patient in the recumbent position, first on the right and then on the left side, to secure muscular relaxation, for it is quite evident that a contracted muscle over a given area of sensitiveness will thwart the elicitation of pain.

If the patient is seated the muscles may be relaxed by having the patient lean backward.

Pressure with the finger (care must be taken that the pressure is equal) is next made over each intervertebral foramen and, if contracted muscular bundles or pain can be demonstrated by the palpating finger, vertebral tenderness is present.

The writer has frequently found that, firm pressure on the sensitive vertebræ may evoke pain in lieu of tenderness and what is of greater diagnostic import is the fact that, some of the sensations from which a patient suffers may be reproduced.

Many recent writers, notably Arnold[17] and Ludlum[18], found that the areas of vertebral tenderness correspond to the vaso-motor centers in the spinal cord and that there exists a compensatory relationship between the blood-vessels of the cord and those structures supplied by the posterior primary divisions of the spinal nerves.

The vaso-motor nerves are evidently not wholly concerned in vertebral tenderness. Physiology teaches that our conscious sensations do not originate in the viscera to which the afferent nerves are distributed and where they are stimulated. On the contrary, the nerves merely transmit the stimuli to the gray matter of the spinal cord (section of which

abolishes sensations of pain without affecting the tactile sensations), whereby through summation they produce changes in the cells of the gray matter. Such changes are identified with hyperesthesia and hence the vertebral tenderness.

It is known that frequently repeated painless tactile stimuli may eventually arouse the sensation of pain.

Again, a *neuritis* at first limited to a visceral nerve may pass upwards (ascending neuritis) and involve larger nerve-trunks or even the spinal cord. It is in this way only that one can explain the vertebral tenderness which persists after apparent recovery from a visceral disease.

In addition to the vaso-motor and sensory reflex phenomena in visceral disease there are also *motor symptoms*. The latter may be experienced by either an irritation or paresis. Thus, in *angina pectoris*, the constriction around the chest is dependent upon a contraction of the intercostal muscles. Paretic symptoms may attend a paroxysm and enfeebled power of the muscles of the left arm is present. In the inter-paroxysmal periods of angina, as well as in other cardiac lesions, sensory, motor and vaso-motor symptoms may be demonstrated in several segments of the spinal cord, and Mackenzie's conception of them is as follows: In cardiac disease (as a paradigm) a persistent irritation of the sympathetic nerve conduces to the irritation of the spinal segment at a site where the fibers of the heart connect with the spinal cord. Irritation of the sensory part of the spine conduces to the sensation which is projected into the periphery innervated by the nerves of the spinal segment (law of Muller). After this manner the motor and vaso-motor symptoms are of like segmental character. The following table fairly represents the areas of vertebral tenderness in visceral disease and corresponds to the distribution of the spinal segments.

VERTEBRAL TENDERNESS IN VISCERAL DISEASE.

VISCERAL DISEASE.*	VERTEBRAL TENDERNESS.
GASTRIC ULCER.	At the level of and to the left of the 10th to the 12th dorsal vertebra.
CHOLELITHIASIS (Gall-stones).	Somewhat to the right of the 12th dorsal vertebra. Painful area may persist for weeks after an attack.
CARDIAC DISEASES.	Usually to the left of the first four dorsal vertebræ.
PULMONARY DISEASES.	From the 3d to the 6th dorsal vertebra.
GASTRIC DISEASES.	From the 4th to the 10th dorsal vertebra.
PELVIC DISEASES.	At the 4th and 5th lumbar vertebræ.

The foregoing table is based on the observations of different writers on the subject and the author presents the following table of vertebral tenderness in visceral disease, which he has elaborated after palpation of the palpable organs and by aid of his visceral reflexes (Fig. 30). Thus, in *myocarditis*, the symptoms of this affection may be elicited by concussion of the four lower dorsal vertebræ (Fig. 5), which manœuver provokes dilatation of the heart. If the counter-reflex of cardiac contraction is provoked by concussion of the 7th cervical vertebra, the area of vertebral tenderness disappears at once.

One may also note that the vertebral tenderness after palpation of an organ is of a few minutes duration only, and

Vide also the observations of the Griffin brothers (page 2).

if present before manipulation of the diseased viscus it is accentuated after such manipulation. The point of tenderness is located either at the side of the vertebræ or at a point 4 cm. from the median line of the spinous processes or in both situations. It is better to determine vertebral tenderness before palpating the organs, for otherwise one is unable

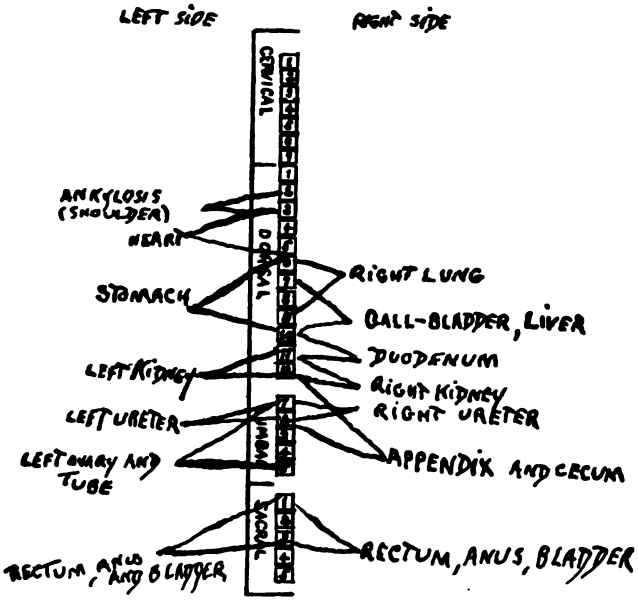


FIG. 30.—Vertebral areas of tenderness after palpation of the viscera. The localization is only approximate.

to say whether the tenderness in question was not already present.

A practical point in relation to these areas of vertebral tenderness after palpating a sensitive organ, joint or tissue is the following fact: If the area of vertebral tenderness is thoroughly frozen, the organ, joint or tissue may be manipulated for a time with either diminished or no pain. Even the subjective pain may disappear for hours after the freezing.

If the sensibility of the skin over the painful organ, tissue or joint is tested with a pin before and after freezing, it will be noted after the latter manœuver that the skin is anesthetic. This anesthesia is likewise of variable duration. The citation of two observations will make my meaning more lucid.

I. The subject has gout located in the left metatarsophalangeal articulation of the big toe. The latter is exquisitively tender on manipulation. There are no vertebral points of tenderness. The toe is now manipulated and whenever it is moved a localized muscular spasm may be palpated at the side of the spine of the 11th dorsal vertebra. Within a minute two points of vertebral tenderness may be located corresponding to the left side of the 11th dorsal vertebra and another about 4 cm. to the left of the spinous process of the latter vertebra.

The vertebral areas of tenderness are now thoroughly frozen and within two minutes the big toe may be manipulated without pain. The skin over the toe in question is anesthetic. The anesthesia lasts only three minutes, but the patient is without pain in the joint until the following day. Again the vertebral area (which has been marked with a stick of silver nitrate to avoid a repetition of localization) is frozen and the patient is without pain for two days. Two more freezings sufficed to control the pain completely.

II. The subject has an ulcer of the stomach. A sensitive vertebral point is already present, but when the tender point over the stomach is subjected to pressure, the vertebral area becomes decidedly more sensitive. The latter area is now frozen, after which procedure the sensitive point over the stomach may be manipulated with scarcely any pain at all. The subjective pains of the patient disappeared for only six hours. Freezing was again executed and the pains evanesced for twelve hours.

Now to the average physician it would be ridiculous to assume that freezing over the area of vertebral tenderness was anything more than a palliative measure, yet sober thought endows *analgesia* with curative action.

The use of anesthetics to wounds will hasten their healing and by so doing we are executing what the author is pleased to call a "peripheral rest-cure." Rest of any kind in the treatment of painful organs or tissues is curative.

The author has seen abraded surfaces on the lips and mucous membranes, which having resisted treatment for months were regarded as clinically malignant. These abraded surfaces were constantly irritated by cauterization and the use of antiseptic lotions, yet in a few days a protective coating of collodion over the abraded surfaces sufficed to cure them.

One must also remember that the nerves which convey sensory impressions also carry trophic fibers.

Take again *coughs*. When the sinusoidal current is used with one electrode over the sacrum and the other applied alternately over the spinous processes, it will be found that a reflex cough can be excited in many instances over the spinous processes of the 6th, 7th, 8th and 9th dorsal vertebræ. Patients with persistent coughs will often show areas of vertebral tenderness corresponding to the vertebræ in question. If now, the tender areas are thoroughly frozen, it is an excellent means of inhibiting a cough. Inhibition of a cough is, in many instances, a curative measure and when we employ narcotics with discretion to subdue a persistent cough in bronchitis and other pulmonary affections recovery is hastened. Concerning the action of freezing for the relief of pain, *vide* page 172.

The author has also noted that areas of *vertebral tenderness* may be elicited when definite areas of the skin are irritated

by pinching or by means of a point of a pin. Such areas of tenderness are likewise of short duration and appear on the same side of the vertebral column (or 4 cm. from the spinous processes) corresponding to the side of cutaneous irritation. The areas of tenderness may not appear for fully a minute after scratching or pinching a definite cutaneous area.

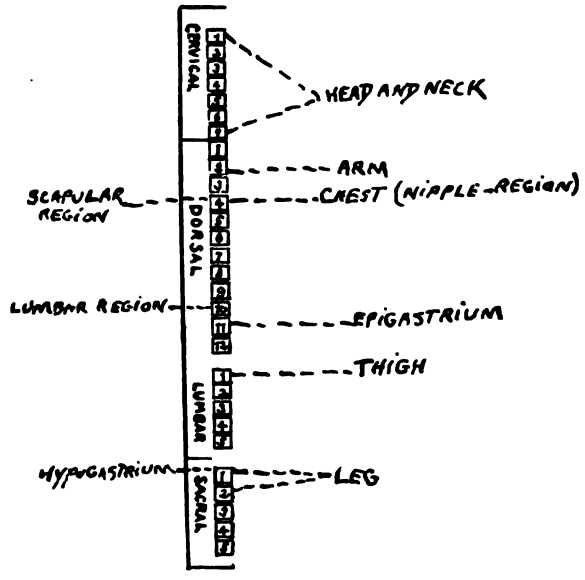


FIG. 31.—Approximate areas of vertebral tenderness elicited after irritation of cutaneous areas in different regions.

Localized spasm of the spinal musculature is associated with the tenderness, *i. e.*, each time the skin is irritated the finger detects a muscular contraction corresponding to the area where tenderness will subsequently appear. By this means one is now in the possession of an objective method for determining pain-reaction to cutaneous stimulation. The intensity of pain is an individual question and depends as much on the sensitiveness of the registering apparatus as it does on the degree of stimulation.

The localization of vertebral tenderness in the writer's experience cannot be governed by any fixed rules, the individual case only must serve as a criterion.

The various therapeutic methods discussed in a subsequent chapter (chapter V), when applied to the areas of tenderness are endowed with considerable value in influencing the visceral condition. This statement applies with special cogency to the vaso-motor and viscero-motor fibers from a given segment.

INTERCOSTAL NEURALGIA is a frequent condition responsible for vertebral tenderness and is discussed at length on page 186.

VERTEBRAL PERCUSSION.

The tracheo-bronchial glands are enlarged in pertussis and in other infectious diseases, notably in children.

In every one of 127 cases of tuberculosis, Northrup found the glands enlarged.

BRONCHIAL PHTHISIS has been fully described in the literature but the scope of such description has been limited in regarding it as an affection peculiar to children with symptoms suggestive of increased intrathoracic pressure.

The author has portrayed[19] a picture of bronchial phthisis occurring in adults which in all essentials tallies with the tableau of symptoms common to pulmonary tuberculosis with which it is frequently confounded. In an analysis by the author of 100 cases of bronchial phthisis the following diagnostic conclusions were formulated:

1. There is a history of cough which is spasmodic in character and almost suggests the brazen, metallic cough of aortic aneurism.

2. Tubercle bacilli may be found in the sputum after repeated examinations, and then only when the bronchial glands have suppurated and perforated the bronchus, or when tuberculosis is present elsewhere in the lungs.

3. Dyspnea is out of all proportion to the signs obtained by physical examination of the lungs.

4. Dullness of the lungs anteriorly and posteriorly, corresponding to the bifurcation of the trachea (at about the level of the intervertebral disc between the 4th and 5th dorsal vertebræ).

5. The Smith and Hare sign, viz., when the patient throws the head well back a "purring" sound is heard when the stethoscope is placed below the suprasternal notch.

6. The Rœntgen ray evidence (enlarged glands), viz., when the target of the tube is so placed that when the rays are traversing the chest, they will fall at a point corresponding to either the right or the left side of the vertebral column posteriorly corresponding to a point just below the bifurcation of the trachea.

Among the signs cited dullness over the manubrium sterni anteriorly and posteriorly corresponding to the 4th, 5th and 6th dorsal vertebræ is common.

It must be recalled, however, that the region corresponding to the 5th dorsal vertebra is normally dull, the dullness extending for a short distance on either side of the vertebral column but more to the right than to the left side. The shape and size of this square patch of dullness, if much modified, may indicate enlargement of the bronchial glands.

The enlarged bronchial glands often escape detection by percussion, owing to vibration of the sternum and spinal column.

Insomuch as the method of *vibrosuppression*[20] is of great value in topographic percussion of the chest, brief reference will be made to it at this time.

If one percusses the normal chest, say beneath the clavicle, a sound is produced which is the product of the vibration of the lung tissue and the thoracic walls. It is

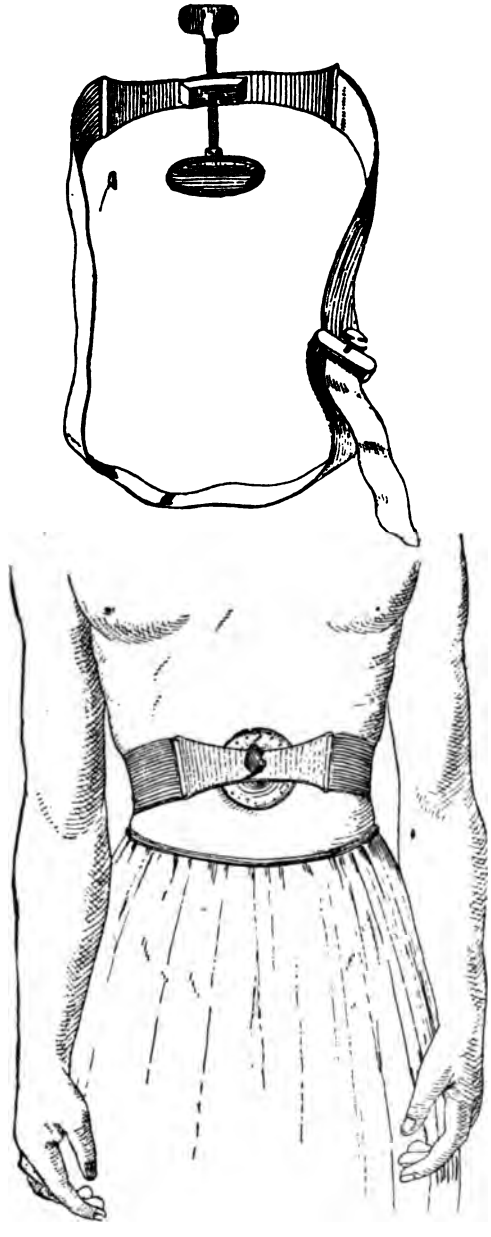


FIG. 32.—The vibrosuppressor and its application to the chest.

the summation of this vibration which interferes with the elicitation of the dullness of the airless organs in juxtaposition to the lungs. If the vibration in question can be eliminated, the definition of the viscera will prove easy of attainment. Briefly, lung resonance is made up of two chief factors, viz., vibration of the air in the lungs and vibration of the sternum. The latter is essentially a sounding-board. Thoracic vibration can be eliminated as far as possible by percussion of the organs at the end of a forced expiration, when there is comparatively little air in the lungs to vibrate, and by suppressing the vibrations of the sternum by means of the vibrosuppressor (Fig. 32).

The apparatus is modeled after a tourniquet, consisting of a pelote, screw, band (6 cm. wide) and clamp for fixing the latter. It is so applied that the pelote rests on the xiphoid cartilage of the sternum. The pelote is made to compress the cartilage by aid of the screw with all the pressure the patient can tolerate. Percussion is then executed during the time the apparatus is employed and preferably during suspended respiration after forced expiration. In the absence of the apparatus, *firm pressure made on the lower end of the sternum* by the hand of an assistant will aid topographic percussion during the time the patient has suspended respiration after forced expiration. More recently, the author has noted that suppression of the vibrations of the spinal column by aid of compression of the latter by the hand of an assistant is of material aid in percussing enlarged bronchial glands and defining the lower border of the liver, spleen and stomach. In many instances it is better to compress the sternum and spine simultaneously.

Among other signs of enlarged glands are those of Grancher (unilateral restriction of breathing) and Petruschky (area of tenderness between the shoulder blades).

CHAPTER IV.

SUMMARY OF SPINAL DISEASES AND SYMPTOMS.

BACKACHE—CHEST DEFORMITIES—COCCYGODYNIA—FAULTY ATTITUDES—LITIGATION BACKS—LUMBAGO—NEUROTIC SPINE—OSTEO-ARTHRITIS—POTT'S DISEASE OF THE SPINE—SACRO-ILIAC DISEASE—SACRO-ILIAC RELAXATION—SPINAL CURVATURES—SCOLIOSIS—KYPHOSIS AND LORDOSIS—ANGULAR CURVATURE—SPONDYLITIS—SPONDYLOLISTHESIS—TRAUMATISM OF THE SPINE—TUMORS OF THE SPINE—TYPHOID SPINE—VERTEBRAL INSUFFICIENCY—DIAGNOSIS OF SPINAL DISEASES—PAINS—DEFORMITY—COMPRESSION OF THE SPINAL CORD—PARAPLEGIA—TUBERCULOSIS—SYPHILIS—GONORRHOEA—RHEUMATISM—RICKETS—SPINAL MENINGITIS.

BACKACHE.

THE popular conception of the etiology of backache in men is the kidney, and in women pelvic disease.

As a matter of fact the kidney and pelvis are infrequently concerned in the etiology of this common affection.

It is practically axiomatic that organic heart-lesions as a rule are dissociated with pain and the same may be said of the average renal disease.

I adopt the following simple manœuver for excluding the kidneys as factors in the causation of backache: Place the pleximeter first over one and then over the other kidney in the lumbar region and practice forcible concussion. The hands (Fig. 3) may be employed for a similar purpose.

By aid of this *transmitted palpation* of the kidneys no pain can be elicited in the norm, but if the pain from which the patient suffers is of renal origin the exact nature of it may be reproduced by this manœuver. This method of transmitted palpation is equally efficient in determining the sensitiveness of the liver.

The lumbar muscles (*lumbago*) are commonly concerned in the etiology of backache and they must be excluded in diagnosis (page 99).

When the muscles in question are involved, bending far forward suddenly will stretch the muscles and elicit pain.

Backache dependent on pelvic or renal disease would be uninfluenced by such a movement.

It must be remarked, however, that the latter movement and pain in LUMBAGO are influenced by the muscles involved. Thus, involvment of the *erectors* permits bending forward, but elicits pain when the vertebral column is straightened; when the *flexors* (quadratus and psoas) are involved, bending forward is painful and rotation of the thigh (psoas) causes distress; when the serratus posticus is involved, deep breathing and not spinal movements causes pain.

Backache may be located in the lumbar, lumbo-thoracic, sacral or coccygeal regions.

In women, the neurotic spine, sacro-iliac disease, constipation, hemorrhoids and pelvic disease are frequent causes of backache. If CONSTIPATION is present in either sex the pain is located in the regions of the ascending and descending colon and is associated with tympanites. The expulsion of gas brings temporary relief and the same may be said of carminatives, purgatives, enemata and a diet (non-amylaceous) which inhibits the formation of gastro-intestinal gases.

In GASTRIC TYMPANITES, backache may be felt in the left interscapular region. The writer has shown[23] how easily the heart may be dislocated by distension of the stomach. It is unnecessary to descant on the practical value of this observation. Heart-dislocation from stomach-dilatation is associated with a circumscribed area of dullness in the left interscapular region. Over this area, bronchial respira-

tion is heard. When the patient leans far forward, dullness and bronchial breathing disappear to reappear when the erect attitude is resumed (Fig. 34).

The foregoing syndrome may be reproduced synthetically by artificial distension of the stomach. An enormously distended heart may produce identical signs.

Artificial insufflation of the colon is incapable of producing the same degree of cardiac luxation. In gastro-intestinal affections, notably ulcerative in character, pain in the back

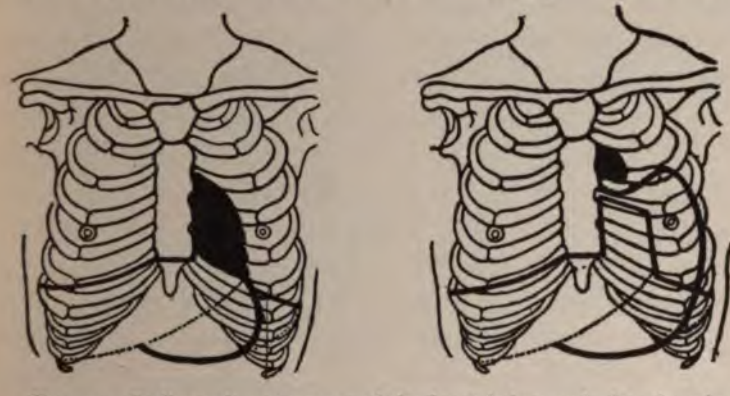


FIG. 33.—Radioscopic appearance of the heart before and after the administration of a Seidlitz powder. The silhouette of the heart is represented by the dark area.

often ensues within a few minutes after the ingestion of fluids and food.

I have employed the phrase RESPIRATORY ATAXIA, to designate many respiratory neuroses which, in my experience, are associated with a defective type of breathing and with inco-ordination of the muscles of respiration. In males, the type is costal instead of abdominal, and in women, abdominal instead of costal. These patients have one symptom in common: A paroxysmal tendency to "catch the breath." There are, however, other symptoms, notably *backache*, syncope, dyspnea, cardiac palpitation and insomnia.

Mere inspection makes the diagnosis, viz., the recognition of the reversed type of breathing. Auscultation elicits no respiratory murmur in the lower lobes of the lungs in males and the upper lobes in females. Encircling the chest with a rubber bandage to exclude costal breathing and the abdomen in females to exclude abdominal respiration brings immediate relief, whereas re-education of the type of respiration results in cure.

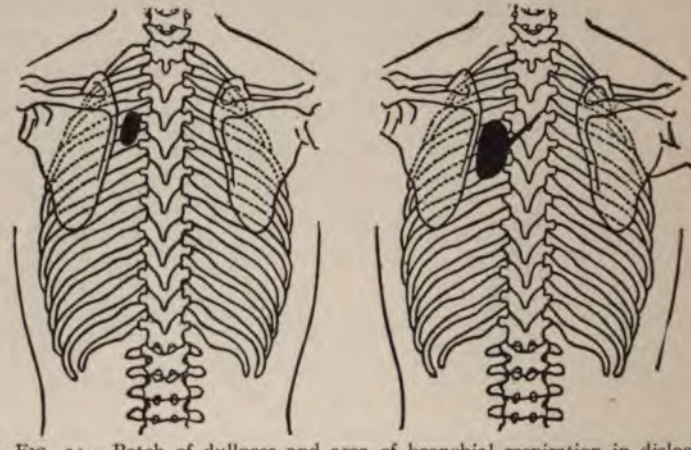


FIG. 34.—Patch of dullness and area of bronchial respiration in dislocation of the heart upward after artificial distension of the stomach. The adjoining illustration shows an increase in the area of dullness when the same patient is leaning backward.

A nasal anomaly may be the exciting factor and this may be demonstrated by the immediate relief of the symptoms following cocainization of the nasal mucosa.

HEMORRHOIDS may induce reflex pains running to the back but more often down the left leg, thus simulating sciatica. As a rule such hemorrhoids have abraded surfaces and for this reason, an ointment containing a large percentage of *orthoform* is effective as a local anesthetic and, in this action a diagnosis may be made.

If, for instance, the pains in the back are ameliorated

after the application of the salve to the hemorrhoid, we know that the latter is concerned in the etiology of the pains. More radical measures addressed to the cure of the hemorrhoids are equally efficient and the author can highly recommend the daily application of Monsel's solution to the hemorrhoids by means of a brush once or twice daily.

Other rectal affections, notably *fissures*, may be excluded by the local application of a 5 or 10 per cent solution of cocain.

One must also think of the POST-OPERATIVE-BACKACHE provoked by the straight dorsal position of the patient during a protracted operation. This may be prevented by flexing the limbs and body and using cushions under the shoulders, knees and small of the back during an operation.

Rose[21] directs attention to a chronic PERIOSTITIS of one of the spinal processes (lumbar and sacral usually) as an important cause of backache. The latter may be detected by the pain produced by pressure with the finger on the implicated spine. Immediate relief is secured by one application of leeches to the spinal process and cure, by the daily application of iodine-tincture and potassium-iodid internally. When over-distended SEMINAL VESICLES cause backache, immediate relief is often achieved by stripping the vesicles.

PROSTATIC DISEASE may cause backache which is often misinterpreted as sciatica or lumbago. This is due to the intimate association existing between the pudic nerve from which the prostate receives its spinal fibers and the roots of the lumbar and sacral plexuses.

A PENDULOUS ABDOMEN may cause backache and this may be demonstrated by the relief secured by raising the abdominal walls with both hands. If the latter manœuver is effective, a proper abdominal support must be worn. Here the pain is probably caused by traction of the mesentery

on the spine. The drag of the abdomen in obese subjects will cause lordosis and strain on the sacro-iliac articulations.

In chronic APPENDICITIS backache may be present and is increased in severity after fatigue. Byron Robinson has shown that the appendix is frequently in contact with the psoas muscle and may, therefore, be bruised by the action of this muscle. With the patient in the recumbent posture sudden extension and flexion of the thigh on the trunk will often elicit severe pain. On the other hand, the pain is relieved when both thighs and knees are partly flexed in recumbency.

ANEURISM of the thoracic aorta is characterised by sharp paroxysmal and lancinating pains. Anginal attacks are not infrequent when the aneurism is located at the root of the aorta. The pains often radiate down the left arm, up the neck or along the upper intercostal nerves. In aneurism involving the descending aorta, one of the most frequent symptoms is pain and Huchard, referring to this form of aneurismal neuralgia, says that when one is dealing with persistent pain of long duration which cannot be explained, which resists ordinary medication and which is either increased or diminished in severity in certain attitudes of the patient, one should always consider aneurism as a probable diagnosis and, if no tumor can be demonstrated, one must have recourse to the X-rays for additional evidence in diagnosis.

If backache is caused by PELVIC DISEASE, palpation of the ovaries and movements of the uterus should reproduce the pains from which the patient suffers. The pain from uterine affections is often located in the upper sacrum and is described generally as a dragging sensation. In such instances retro-flexion is the most common cause.

Referring to the pains of pelvic inflammations, Kelly

makes the following pertinent observation: Inflammatory pain has a definite habitat. . . . The pain of inflammation is a fixed point; it is never in one place to-day and then at some remote part of the body to-morrow, one day in the shoulder and the next in the foot or calf of the opposite leg. . . . . It is a safe working hypothesis to conclude that a patient who complains of a definite pain and who from day to day and week to week is definite in her complaint as to the character and seat of the pain, has some gross lesion. Garrigues[22] divides pelvic backaches into two varieties:

1. When pain and tenderness are located at the 4th and 5th lumbar vertebræ (spinal-center for the internal pelvic organs);
2. When a tender spot can be located on either side of the 2nd sacral vertebra.

The latter variety is caused by a cellulitis of the utero-sacral ligaments.

Garrigues contends that in the norm the utero-sacral ligaments are so elastic that the uterus can be brought forward bimanually until arrested by the pubic bones. When the ligaments are inflamed, any movement of the uterus forward causes acute pain in the back.

Many persistent backaches in women owe their origin to improper methods of DRESS. Here an important element is the pressure of corsets.

In the developmental period of some of the ACUTE INFECTIONS, notably small-pox, dengue and influenza, backache is a frequent concomitant, the pathology of which is obscure.

Associated with what is known as INDURATIVE HEADACHE (which, according to Edinger, is regarded as the most frequent form of headache) there are also pains in the neck

and back caused by indurations within the bodies of the muscles due to a chronic myositis.

The indurations are painful on palpation and may feel like grains of shot. They are most frequently located in the muscles of the head and neck, although other sites are not exempt (Fig. 35).

FIG. 35.—The most common sites of indurations (modified from Edinger by Yawger).

Several months may be necessary to effect a cure and this may be attained by removal of the indurations by means of vibration and Galvano-therapy but most effectually by massage.

This subject is more exhaustively discussed elsewhere.[36]

One must remark, however, that fibrous indurations are

not essentially rheumatic insomuch as they may also follow infections and local injuries or strain of the muscles. In my experience, the indurations are best detected by relaxing the affected muscle and then rubbing the skin with vaselin when firm pressure with the finger will demonstrate the nodules. After a few séances of massage the indurations will become more defined.

Depage, of Brussels, directs attention to the infrequency of backache (in 10 to 15 per cent of the cases) in *floating kidney* (nephroptosis) and observes that, notwithstanding nephrorrhaphy, the pains in the back continue. Here, as in backache referred to other causes, the following condition has been overlooked by clinicians, viz., owing to deformity of the ribs, the 10th or 11th rib comes in contact with the crest of the ilium either on one side or the other and the rubbing thus provoked gives rise to a dull, intermittent pain which is accentuated by movements. The false position of the ribs may occur as a result of scoliosis. The 10th and 11th ribs are painful on palpation and there is little or no space between the lower ribs and the crista ilei. Resection of the anterior ends of the ribs in question resulted in cure when mechanotherapeutic methods failed.[55]

SYNOPTIC TABLE OF BACKACHES.*

DISEASES OF THE SPINAL CORD.

LOCATION OF PAIN.	CONCOMITANT SYMPTOMS.
In distal parts of the body dependent on the pain-fibers that are irritated.	No spinal rigidity nor vertebral tenderness. Dependent on the segment of the cord involved, motor and sensory disturbances are present with loss of reflexes.

*The essential facts of this table have been gleaned from a paper by Dr. C. M. Cooper of San Francisco, which was kindly placed at the disposal of the author prior to its publication.

DISEASES OF THE SPINAL-ROOTS AND MEMBRANES.

May occur either in juxtaposition to the lesion or in distal parts and is intense and shooting in character.

Pains occur in definite anatomic zones and are inclined to encircle half the trunk or shoot into the extremities. Spinal rigidity and tenderness are usually absent, thus excluding vertebral disease. If a single nerve-root is involved it may be the precursory symptom of *herpes*.

DISEASES OF THE VERTEBRAL COLUMN.

Pains are root-like in character with or without vertebral tenderness.

Deformity may or may not be present. Usually spinal rigidity and impaired mobility corresponding to the vertebræ implicated. The nature of the spondylitis (*q. v.*) must be determined.

EXTRA-VERTEBRAL ARTICULAR DISEASES.

Pains may be confined to the region of the ribs, scapulæ or ilia. In abnormal sacro-iliac mobility (*vide* sacro-iliac disease), pain is referred to the sacro-iliac joints or sacrum.

Backache is worse in the recumbent posture and referred pains innervated by the lumbo-sacral cord are frequent.

DISEASES OF THE MUSCLES AND LIGAMENTS OF THE BACK.

Usually described under the generic term *lumbago*. Pains are increased by movements which contract the muscles. Muscles tender when compressed by the fingers. The Faradic current is useful in diagnosis (page 99).

Rigidity of the back-muscles may be present but no pain can be elicited by percussion of the vertebræ and there are no nerve-root pains.

BACKACHES FROM STATIC ERRORS.

In taking the strain off of distal anomalies, the muscular fatigue graduates into pains. Rotary or lateral curvature may be present.

The diagnosis is established when the flat-foot or knock-knee is remedied by some orthopedic manœuver.

BACKACHES FROM VISCERAL DISEASE.

Usually referred pains, which are sharp, aching or stabbing. Hyperesthesia over zones corresponding to the areas innervated by the disturbed spinal-segments (Figs. 23, 24, 25 and 26) and tenderness and rigidity of the muscles innervated by the same segment. Location of pain suggests organ involved: 1, between the shoulders, *gastric pains*; 2, right shoulder blade or tip, *hepatic* disease; 3, left shoulder blade, *overloaded heart*; 4, dorso-lumbar region, *varicocele, loaded colon, ovarian* or *testicular disease*; 5, angle between lowest rib and erector spinæ muscle, *kidney-stone*; 6, loin, *kidney disease*; 7, base of sacrum, *prostatic* or *uterine* disease; 8, sacro-iliac synchondrosis, distended *seminal vesicles, inflamed utero-sacral ligament, pelvic* and *rectal diseases.*

The visceral stimuli may be:

1. Spasm in a hollow muscular organ (ureteral colic);
2. Distension of a capsule (enlarged spleen, liver or kidney)
3. Inflamed serous coverings (adherent appendix);
4. Insufficient blood supply (abdominal arteriosclerosis);
5. Excessive functioning (excessive venery);
6. Pressure (tumors and aneurisms);

Visceral pains are dissociated with excessive vertebral tenderness or stiffness or by movements which call the fasciæ and ligaments into play as in lumbago.

SPECIAL BACKACHES.

1. POST-OPERATIVE BACKACHE.—After operations in the supine posture due to improper support of lumbar arch with muscular relaxation during anesthesia. The backache in women occurring at night is due to improper support of the lumbar arch and may be prevented by a pillow under the loins during sleep.

2. PROFESSIONAL BACKACHE.—Observed in dentists and surgeons who assume a constrained posture and the

remedy consists in raising the right leg and placing the right foot on a stool; thus the lumbar spine is partly unarched and strain is removed from the stretched ligaments.

3. HYSTERICAL BACKACHE.—*vide* hysterical spine.
4. COCCYGODYNIA (page 95).

CHEST-DEFORMITIES.

The configuration of the thorax is frequently modified as a sequence of curvature of the spine and the deformities are as follows : kyphotic, scoliotic and scolio-kyphotic. Such deformities are readily recognized by the short thorax, low stature and the exaggerated breadth of the shoulders.

The RACHITIC chest is especially characterized by the keel-shaped prominence of the sternum (pigeon-breast) and may be associated with deformities of the spine, notably scoliosis and kyphosis. The BOAT-SHAPED chest (*thorax en batteau*) has only been observed in syringomyelia and consists of a depression in the median line of the upper portion of the anterior chest-wall.

In the ALAR or PTERYGOID chest there are prominent scapulæ.

Projection of one scapula indicates the presence of a lateral curvature.

In 1743, Hunauld described the condition known as CERVICAL RIB. The anterior limb of the transverse process of the 7th cervical vertebra has an independent center of ossification and may develop into a separate bone (known as a cervical rib), which may not extend beyond the transverse process or may form a complete rib attached anteriorly to the sternum. A cervical rib may be present either on one or both sides. Since the employment of X-rays in diagnosis, the cervical rib is more frequently recognized and is not an uncommon condition in explaining many vascular

and nervous symptoms referable to the upper extremity and neck. A supposititious osseous growth of the neck may be a cervical rib or exostosis emanating from it.

A cervical rib may exist with or without symptoms. In the former event, the symptoms are associated with pressure on the subclavian artery (aneurism, gangrene of the hand and minor vascular affections) and on the brachial plexus (neuritis). The symptoms may develop suddenly in children and adults.

COCCYGODYNIA.

This is a neuralgia of the coccygeal plexus and is also known as coccydynia. The chief sign of this affection is pain in and around the coccyx which is accentuated in the sitting posture (sitting-pain), by rising, walking, urination, defecation, coitus and during pregnancy. Pressure on the coccyx is painful. The pain may be intermittent or continuous and dull or neuralgic. With the patient in the dorsal or the left lateral position by grasping the coccyx between the index finger (in the rectum) and thumb and moving the coccyx, the pain from which the patient suffers may be reproduced and in this sense such an examination is diagnostic.

The affection is chiefly confined to women and is occasionally observed in children. In quack literature the affection is often described as the "elongated spinal column."

Occurring rarely in males, it owes its origin to some sexual anomaly.

The etiology is obscure, the predominant factors being traumatism (horse-back riding), pregnancy, labor, rheumatism and pelvic diseases.

Many writers regard the affection as a neurosis or neuralgia and the success attending Graefe's method of treatment would suggest the latter hypothesis as correct in the majority of cases. Graefe cured all his cases within

twelve séances by applying one pole of the Faradic current to the sacrum and the other pole to the coccyx and surrounding tissues.

FAULTY ATTITUDES.

Above the age of twelve years the normal attitude may be roughly estimated by aid of the plumb-line held against the back of the sacrum; this line approximates the convexity of the dorsal spine.

The FLAT BACK is observed in children with a tendency to scoliosis and the HOLLOW BACK (lordosis), unless due to disease, is usually an anomaly of conformation. ROUND SHOULDERS are associated with the following attitude: head is flexed and carried forward, the shoulders are drooping, the chest is narrow and flat, the scapulæ are prominent and the physiologic curve in the dorsal region is accentuated. The age of puberty is the usual time for the occurrence of round shoulders. The etiology is identified with general muscular weakness (especially of the posterior shoulder-muscles), defective hygiene, supporting the clothing from the shoulders in lieu of the waist, and protracted spinal flexion from incorrect school furniture which lends no support to the back.

In PARALYSIS AGITANS the attitude is characteristic: head and body are bent forward with trunk flexed on thighs and fore-arms on the arms. The other essential points in diagnosis are: tremor at rest ceasing upon voluntary movements, mask-like face, monotonous voice and rigidity of the back.

In CERVICAL CARIES the head is held to one side, supported by one or both hands in a fixed position. In PSEUDO-HYPERTROPHIC MUSCULAR PARALYSIS, the enlarged though feeble muscles, and the attitude (legs far apart, shoulders

thrown back, abdominal protrusion and lordosis) are characteristic.

In SHOULDER MALPOSITIONS, with drooping of the shoulder forward, rotation of the scapula lowers the glenoid cavity, thus causing the humerus to rest against the ribs and by so doing, the axillary structures are compressed, resulting in circulatory disturbances in the hand and pains in the distribution of the brachial plexus.

LITIGATION BACKS.

As a result of accident, many individuals suffer from symptoms referred to the back which in reality do not exist and which often evanesce after a favorable verdict by a jury.

It is easier for a patient to simulate a disease which gives little objective evidence, hence the nervous system is a prolific field for the malingerer.

Simulation of organic nervous disease is extremely difficult, and for this reason, the symptomatic picture is essentially neurasthenic. Simulation can only be excluded by the physician after a thorough objective examination of the nervous system. The behavior of the patient, when his attention is diverted from his symptoms, must be carefully noted. Disease of the cord and membranes may be excluded if the reflexes are intact and if there is no distal spasm, paralysis or anomaly of sensation.

Vertebral implication is excluded if there is no vertebral tenderness, deformity or limitation of spinal movement.

If unilateral spasm is present it cannot be feigned.

In real PARALYSIS, any change in the condition of the muscles cannot be feigned. In simulated paralysis, movement of the involved limb may show some muscular stiffness if it is suddenly raised or dropped, or, if motion is secured by

painful stimuli such as the prick of a pin or a powerful Faradic current.

Under anesthesia the patient may execute movements of a simulated paralyzed extremity and in one case of malingering, the author induced the malingerer to move his limb during hypnosis.

ANESTHESIA is easier of simulation than the preceding symptom, for the reason that sensibility varies even in the norm. Thus women are more tolerant to pain than men and even in healthy criminals analgesia is frequently observed. Polish Jews are said to show anomalies in the perception of pain. Bailey[25] asserts, that there are many individuals who can suppress any evidence of pain as long as their attention is fixed upon this object.

The "human pin cushions" in museums really suffer pain, but in consideration of the salary they receive, willingly submit to the thrusts of the pin.

In making a sensory examination, the eyes must be blindfolded and the tests must be executed without any fixep system. Thus, when one leg is being examined, prick the anesthetic leg quickly or employ a Faradic current and suddenly use the full force of the battery. Again, mark with a pencil on the skin the areas of anesthesia and examine later to observe if the areas correspond.

Feigned anesthesia is not limited to the exact distribution of the peripheral nerves, nor to the sensory distribution of the spinal-segments.

To determine objectively the existence of PAIN, the signs noted on page 70 may be employed.

The REFLEXES are not under control of the will, hence, if modified or lost, feigning may be excluded. It is true, however, that the knee-jerk may be inhibited if the patient firmly contracts the knee-muscles.

LUMBAGO.

A muscular rheumatism (*myalgia*) limited to the muscles of the loins and their tendinous attachments is known as lumbago.

An attack of lumbago may occur suddenly after stooping, or a sudden twist, hence the phrase, "kink in the back" or "*Hexenschuss*" (witches' shot), as the Germans call it.

The differentiation of pain located in the muscles or vertebral ligaments is often difficult of attainment, yet, one may say, that if the pain is worse in straightening up, the erector spinæ muscles are involved, whereas implication of the ligaments is probably present when the greatest pain is experienced when the patient bends far forward.

Schreiber notes than an intense dull pain extending from the sacrum to the 3rd dorsal vertebra dissociated with any limitations in the movements of the spine, indicates the involvement of the fascia lumbo-dorsalis. Difficult bending forward suggests implication of the flexor muscles (psoas and quadratus). Involvement of the psoas is indicated by the pain evoked in rolling the thigh outward. Pain in the region of the 4th and 7th ribs uninfluenced by bending the spine but accentuated by breathing, suggests involvement of the serratus posticus.

In general, muscular pain is diagnosed when the muscles are tender on pressure and passive stretching or active contraction accentuates the pain.

When the muscles cannot be grasped between the fingers, muscular contraction may be provoked by the Faradic current and after this manner, the areas of sensitiveness may be elicited. This current is therefore equally efficient in differentiating myalgia from pains of other origin.

Myalgia, in contradistinction to neuralgia, shows no

periods of exacerbation, but becomes accentuated from pressure and active and passive movements and the muscles may show changes in volume and consistency. From vertebral disease, the diagnosis is usually not difficult (*vide* backache). It must be emphasized, however, that persistent lumbago may be a symptom of masked Pott's disease.

Lumbago caused by fatigue is ameliorated by massage, which removes the fatigue-toxins.

Myalgia may also be provoked by an intramuscular neuritis or by pressure on the intramuscular nerves by the indurated connective tissue of the muscles (page 89).

Myalgia of rheumatic origin yields to the salicylates and when associated with a toxemia dependent upon some digestive anomaly, small doses of calomel followed by a saline is an effective measure.

Strapping would be equally efficient in pain of muscular or vertebral origin, whereas acupuncture (page 146), if efficient, is practically diagnostic of a myalgia.

By means of strips of adhesive plaster (preferably zinc oxid) properly applied to the lumbar muscles without including the spine, immediate relief is often obtained in myogenic pain. Almost miraculous in action is freezing (page 172) of the skin overlying the affected muscles. Unless relief is immediate after the use of freezing no results can be expected from its repetition.

Myalgia of gouty origin demands the employment of remedies addressed to the gouty state.

In URIC ACID LUMBAGO dependent on a supposed precipitation of uric acid in the muscles of the back the local application of OIL OF WINTERGREEN (by massage) is, according to Haig, both diagnostic and curative. For purposes of massage I employ an electric massage-apparatus, which is illustrated in Fig. 36.

The author does not seriously consider the so-called uric-acid theory of disease, yet he feels that in a book of this character, he dare not obtrude his personal opinion nor

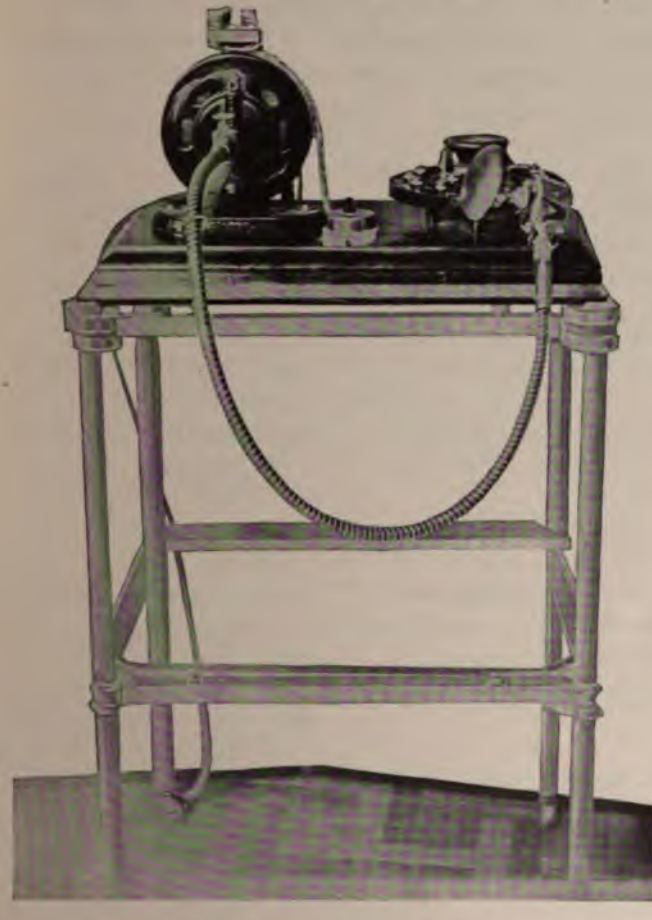


FIG. 36.—Electric massage-apparatus for inunction.

demolish a theory which has won favor. Therefore, a few words are pertinent respecting this theory. Many causes have been assigned for the uric-acid diathesis, but in reality

the essential cause may be thus summarized: excessive eating and drinking with deficient muscular exercise.

There is practically no known remedy for eliminating uric-acid from the blood and one is constrained to have recourse to a diet with the object of diminishing the ingestion of foods containing uric acid. Adams suggests the following diet-lists in cases of uric-acid intoxication.

MAY BE EATEN.

White Meat of Chicken, Sparingly.
Fat Bacon or Fat Pork or Ham.
Macaroni, Spaghetti, Vermicelli.
Barley, and all Cereals and "Flaked" Breakfast Foods.
Potatoes in all forms but Fried. Sweet Potatoes.
Kale and Spinach, Sparingly.
Flounders, Fresh Cod, Hake or Haddock.
Fresh Fish, Soup or Chowder.
Vegetable Soups, with Barley.
Game, once a week, Sparingly.
Cheeses of all kinds. Very useful.
Stale Bread, Crackers, etc.
Rusks, Cake without Eggs.
Raw Cabbage, "Slaw."
Corn on the Cob or from the Tins.
Cucumbers, Lettuce, Parsley.
Dandelion, Beet and other "Greens."
Beets, Turnips, Squash, Pumpkins.
Puddings of Crackers, Bread, etc., without eggs.
Rice, Sago, Tapioca.
Milk, Buttermilk, "Cereal Coffees."
Chestnuts, Almonds, Walnuts, Pecans, Grapes, Raisins, Figs,
Apple Sauce, Pears, Lemons. Grape Fruit, Oranges.
Dried Fruits in Sauces, Sweetened only when cold and ready to eat.

TO BE AVOIDED

Eggs, and foods containing them.
Beef.
Veal.
Pork.
Mutton.
Lamb.
Beef Tea.
All Soups made with Meats.
Pickled, Salted or Preserved Fish.
Salmon, Bluefish, Mackerel or any Oily Fish.
Mushrooms.
Celery, Kale.
Tomatoes, Rhubarb.
New Bread or Biscuit.
Made Dishes, as Puddings with

Potted or Preserved Meats.	Eggs.
Lobsters, Crabs, Clams, Oysters.	Hot Griddles, Waffles, etc.
Dark Meat of Chicken or Fowl.	Beer, Wine, Whiskey and all
Liver, Sweetbreads, Kidneys, etc.	Alcoholics.
Beans, Peas or Lentils, Dried, in	Tea, Coffee, Cocoa and Chocolate.
Soups or Baked.	Peanuts.

Bananas, Gooseberries.

TRAUMATIC LUMBAGO often follows injuries of the vertebral column and is dependent on strain or laceration of the tissues which protect the spinal cord. Injury of the spinal cord is excluded by the absence of paralysis, anesthesia and loss of sphincter-power. In this form of lumbago there is pain in the back, aggravated by motion. Painful areas may be detected over the vertebral spines and muscles, and the latter are usually in a condition of spasm.

Vide osteo-arthritis (page 105) which is often falsely designated as lumbago.

NEUROTIC SPINE.

In hysteria and neurasthenia, spinal symptoms may predominate conducing to a condition known as spinal irritation or spinal neurasthenia. Among the symptoms are: weakness and pain in the back and intercostal-like neuralgic pains, which shoot down the legs.

The rachialgia may only appear after exhaustion or movements of the spine or it may occur spontaneously. In practically all cases areas of tenderness may be elicited on the spine.

The diagnosis of the neurotic spine is based on the diagnosis of neurasthenia and hysteria.

In neurasthenia, the chief symptom is tire, without which sign the disease cannot be said to exist.

Amyosthenic symptoms are present (page 52), and it is

evident, that if the back-muscles (which are the only agents in maintaining the spine erect) are involved in the hypotonicity, backaches must be of frequent occurrence.

Respecting the diagnosis of hysteria, one searches for the stigmata (anesthesia, hyperesthesia, etc.).

According to the modern conception of hysteria, the so-called stigmata are of artificial production, evoked by the suggestion of the physician during his examination; hence the stigmata are characterized by mobility, variability and incertitude.*

If anesthesia is present it may be revealed by certain manœuvers. In the method known as TRANSFERENCE, if a coin or any metal is placed on an anesthetic area, the latter will show a return of sensibility, whereas another area with normal sensibility may become anesthetic. The manœuver may be reversed by placing the coin over an area of normal sensibility; this in turn becomes anesthetic and sensibility is restored in another anesthetic area.

Janet suggests an ingenious manœuver. The patient, let us assume, has an anesthetic area on the back. He is told to say "yes" each time he feels the prick of the pin and "no" when it is not felt. The examination must be conducted rhythmically so as to give the patient no previous warning. If the patient says "no" when the anesthetic area is touched, the nature of the anesthesia is revealed insomuch as the patient could not say "no" if tactile sensation were not present. In hysteria, the psychic origin of the disturbed sensations is further revealed by the fact that they bear no relation to the distribution of the sensory nerves nor to the segments of the spinal cord.

The neurotic spine is frequently associated with diseases

*This conception merits modification in traumatic neuroses (page 377).

of the pelvis insomuch as areas of hyperesthesia are frequently located over the ovaries (ovarian tenderness).

In the majority of instances the ovaries are not implicated and, if bimanual examination of the pelvis is made and the finger in the vagina is made to approximate the finger on the area of tenderness, it can easily be demonstrated that the pain is located in the abdominal walls and not in the pelvic organs.

OSTEO-ARTHRITIS.

Synonyms.—Rheumatoid Arthritis; Arthritis Deformans; Chronic Rheumatic Arthritis; Rheumatic Gout.

In this affection pronounced structural changes in the joints and cartilages are present. When the spine is involved, there is hypertrophy and overgrowth of bone.

The x-rays have been a valuable aid in the recognition of these changes which, when present, exclude rheumatism, insomuch as the latter affection is unattended by pathologic alterations in the cartilage and bone.

The affection usually occurs between the ages of thirty and fifty years and women (notably those who have pelvic disease or are sterile) are as frequently affected as males.

The affection is neither related to rheumatism nor gout.

It was formerly held, that the disease was dependent on lesions of the spinal cord owing to the occurrence of muscular atrophy, pain, neuritis, increase of reflexes, etc., but the modern theory is in favor of a chronic infection resulting from gonorrhea, influenza and other infectious diseases. In *children*, Still has described a form characterized by enlargement of the joints and swelling of the lymph-glands and spleen. The onset usually occurs before the second dentition and girls are more frequently affected than boys. The children are puny and show arrest of development.

Spondylotherapy

Nathan[48] describes a metabolic form of osteo-arthritis which is characterized by a symmetrical involvement of many joints with swelling and increasing deformity. Radiograms show a peculiar punched-out rarefaction in the early stages, and absorption and distortion in the late stages without the presence of proliferative processes or bony ankylosis. It is interesting to observe that in such cases the employment of the *thymus* shows a remarkable effect. One begins with two five-grain tablets thrice daily. In a couple of weeks the dose is increased to three tablets and after a month three tablets four times a day are given.

A *toxemic factor* has been recognized in the etiology of arthritis deformans and treatment directed toward a pyorrhea alveolaris or albuminous putrefaction of the intestines has been followed by satisfactory results. In the latter condition, indicanuria is present. Intestinal putrefaction is combated by interdicting meat in the diet, the use of intestinal antiseptics, the employment of laxatives to produce daily movements of the bowels and the use of soured milk (one or two pints daily). The latter may be substituted by tablets containing lactic acid bacilli, but care must be taken that the products are reliable.*

It is the VERTEBRAL form of this affection which is of particular interest to us. Here there is a progressive ankylosis of the vertebræ conducing to spinal rigidity (poker-back). This condition has been described as SPONDYLITIS EFORMANS, of which there are two varieties; that of Von chterew, which is either hereditary or secondary to a ma in which nerve-root symptoms (anesthesia, pain and lar atrophy) predominate and the spine alone is d. In the Strumpell-Marie type, also known as

*This subject is more fully discussed on page 344.

SPONDYLOSE RHIZOMÉLIQUE, the spinal signs are less characteristic and the shoulder-joints may be involved as well as the hip.

When the spine in the lumbar region is involved, the pains may simulate sciatica or lumbago; in the cervical region the pains are referred to the neck and arms and in the dorsal region along the intercostal nerves.

My friend, Dr. S. J. Hunkin, who has had an extensive experience, contends that probably most lumbagos and sciaticas are of osteo-arthritic origin. Spondylitis deformans is about three times as frequent in men as in women and the ages of predilection are from twenty-five to forty-five years.

The LABORER'S SPINE (*duplicature champêtre* of Marie), occurring in laborers who must adopt the stooping posture, must not be confused with this affection. In the laborer's spine, the entire spine is never "welded together" and there is no exostosis nor decided ankylosis of the joints of the extremities.

In the diagnosis of osteo-arthritis, mention has been made of the X-ray plate for revealing the osseous overgrowth. The latter may also be revealed by palpation, which shows thickenings or nodes.

If the affection implicates the spine, the range of motion is limited and the lordotic curve instead of ending at the 10th or 11th dorsal vertebra, runs up to the 7th or 8th dorsal vertebra or perhaps higher (Hunkin). Involvement of the vertebræ is further noted by limitation of the hip-movements and stiffness of the back. The normal curves are accentuated, notably the lumbar and dorsal ones, and the patient is bent in walking. If there is any ankylosis between the ribs and the spine the breathing is abdominal, owing to deficient expansion of the chest. Diminution or absent chest-expansion shows implication of the articulation of the ribs.

If there is any motion in the spine it is painful and may be associated with crepitus. It is necessary to distinguish loss of motion due to muscular spasm and locking of the joints by the osteophytes.

Little nodules (Heberden's nodosities) may be felt upon the sides of the distal phalanges.

Although this disease is regarded as incurable, *thiosinamin* may be tried or anesthesia employed.

Fibrolysin is preferable to thiosinamin and is used hypodermatically. The drugs in question soften scar tissue.

Anesthesia is effective for a dual reason; if the ankylosis is fibrous it may be forcibly overcome.

Again, Marshall[26] has recently shown the following reaction after ether-anesthesia in the usual manner from a cone for fifteen minutes in osteo-arthritis without apparent infection; complete subsidence of pain, restored motion in the involved joints and partial disappearance of periarticular swellings. Amelioration may not occur for twenty-four hours and the relief between anesthesia and the return of pain is from two days to two weeks. Acute, show more decided changes than chronic cases. If the patient is made worse by the anesthesia the arthritis is probably of infectious origin. The therapeutic value of repeated anesthesias was not determined, owing to the insufficient number of cases.

Relief of pain in the early stages of the disease is secured by fixation of the spine, but later, such immobilization is not indicated owing to ankylosis, which must be prevented by active and passive movements.

POTT'S DISEASE OF THE SPINE.

This refers to a progressive tuberculosis of the vertebral bodies or discs, eventuating, as a rule, in ankylosis and kyphosis. The disease is localized in order of frequency as follows:

1.—Dorsal;
2.—Lumbar;
3.—Cervical portion of the vertebral column.

The great majority of cases occur before the age of fourteen years and one or several vertebræ may be simultaneously involved. The disease is equally common in the male and female. Heredity, traumatism and the diseases of children which enervate the vitality, are frequent etiologic factors.

The tuberculous lesion in this disease is usually located in the body of the vertebra leading to disintegration of the osseous structure which may terminate in caries or suppuration. In consequence of softening and absorption of the vertebræ they cannot sustain the superimposed weight, hence deformity (kyphosis) results.

When the disease involves the last vertebra, the deformity resulting causes the lower lumbar vertebræ to project over the brim of the pelvis like a roof (*vide* spondylolisthesis).

MUSCULAR SPASM is an early and characteristic symptom manifested by anomalous attitudes, lateral deviations of the column and reduced flexibility of the spine.

Muscular rigidity is so important an early sign that the following rules of Lloyd[27] are apropos:

1. If stiffness is present when the patient is told to nod the head affirmatively, there is occipitoatloid disease.
2. If stiffness is noted when the patient is directed to look far to the right or to the left, there is atloaxoid disease.
3. When the shoulders are firmly fixed to the back of the chair and the eyes are carried back along the ceiling, any stiffness suggests disease below the second cervical vertebra.
4. Place the patient prone on the lap and indicate the tip of each spinous process with a pencil, after

which direct the child to stand straight and note if any of the pencil-marks approximate; if two or more marks do not approach each other approximation is prevented by rigidity and the disease is in the dorsal region.

5. To detect lumbar rigidity, place the nude patient upon a couch and grasp the ankles and raise the pelvis. If the lumbar spine is flexible the pelvis is lifted without raising the chest from the couch and the movement deepens the hollow of the loin. If the lumbar spine, however, is stiff, the trunk is raised and there is no alteration of the outline of the lumbar spines. In Pott's disease, when the child is directed to pick up an object from the floor, the knees (not the back) are bent.

PAIN, usually dull, may be located at the site of the disease or referred to the peripheral distribution of the irritated nerves, and it is for the latter reason, that the child may be treated for some visceral affection.

Bilateral pains (sciatica and intercostal neuralgia) are suggestive of vertebral disease and chronic bilateral belly-aches in children are diagnostic according to Lloyd. Pain and tenderness in the back suggest abscess-formation. Very often the pain of dorsal disease may be assuaged by raising the shoulders and in cervical disease by lifting the head.

DEFORMITY, especially when angular and in the median line, is pathognomonic of this disease. Angular deformity is noted more often in regions where the normal curves are posterior than when they are anterior.

A skiagram is invaluable in the early diagnosis of Pott's disease.

When the disease has subsided, there is no longer any tenderness of the spine to vertical pressure, and jarring of the column in various ways causes no inconvenience. Rigidity

may continue as a result of the welding together of the affected vertebræ.

In adults and less often in children, Pott's disease may occur without deformity and the only symptoms may be the signs of a spinal abscess and implication of the cord and spinal roots.

SACRO-ILIAC DISEASE.

Synonyms.—Sacro-coxitis; Sacro-coxalgia.

This is either an acute or chronic tuberculous disease of the sacro-iliac articulations,* commencing either in the synovial membrane or bone, and is practically identical with Pott's disease of the spine. It occurs most frequently in early adult life and the predisposing cause is identified with occupations (equestrians) exposing the joints to traumatism.

The pain in this disease may be confined to the affected joint or may be referred to the distribution of the dorsal or sciatic nerves. It usually begins on getting up after a night's rest and is accentuated by all movements which jar the joint. Examination *per rectum* will reveal tenderness over the joint. The pathognomonic sign is the following: pain in the joint when the sides of the pelvis are pressed together. In walking, the steps are cautiously made to avoid all jars to the joint and the patient walks chiefly upon the ball of the foot and the body is inclined toward the sound side with tilted pelvis. Examination of the joint shows swelling and elevation of local temperature.

SACRO-ILIAC RELAXATION.

The sacro-iliac joint is a true joint and may be the site of the same diseases as other joints.

*The two superior posterior spinous processes of the ilium are on a line with the third sacral spine, below which are the sacro-iliac joints.

Goldthwait,[28] refers many backaches in women to luxation of the sacro-iliac joints. Even in the norm, the latter show definite motion which, during pregnancy and menstruation, is augmented. These joints are also relaxed in consequence of traumatism and general weakness. The so-called "stitch" in the back, from strain or overwork, represents a strain of the joint in question. The backache occurring in the morning after sleep and after operations is referable to the general relaxation following the dorsal posture which strains the lumbar spine and draws the sacrum backward.

It is suggested that the backache thus produced is commonly relieved by stretching upon first waking, which draws the lumbar spine forward.

Drag of the abdomen in obese individuals is often a source of sacro-iliac weakness in consequence of the lordosis and pelvic-joint strain.

The most frequent symptom in sacro-iliac relaxation is backache referred either to the sacro-iliac articulations or the sacrum. The backache may develop during sleep, owing to the recumbent posture. The lumbo-sacral cord passes directly over the upper part of the sacro-iliac articulation and the pressure thus induced accounts for the referred pains in the lower extremities. Objectively, one may note when the patient stands, an obliteration of the lumbar curve of the spine.

The diagnosis of sacro-iliac relaxation is often made by the therapeutic results. Thus relief at night is attained by lying on a firm bed with a firm hair-pillow under the hollow of the back. If the joints are strained or only relaxed, some support to the pelvic bones, like adhesive straps or a wide webbing belt fixed to the base of the corsets and kept up by the insertion of light steels, may be employed. If

luxation of the upper part of the sacrum is present, it may be corrected by extending the spine; legs on one table and head and shoulders on another table with the face downward and the unsupported body hanging between. After this manner, the sacrum is replaced and a plaster-jacket is applied.

Sacro-iliac relaxation is frequently confounded with sciatica and lumbago. It is differentiated from the former, by the absence of pain on pressure along the sciatic nerve and from the latter, by the absence of pain on pressure over the lumbar muscles and free motion of these muscles. In the diagnosis of relaxation of the sacro-iliac joint, one must not forget that a rectal examination will often reveal a tender point on either or both sacro-iliac joints. If certain movements cause pain and the cause is sacro-iliac relaxation, the same movements may be made without pain during the time the sides of the pelvis are compressed by the hands of the physician.

SPINAL CURVATURES.

The curves of the normal spine have already been discussed (page 39). The chief varieties of curvature are:

1. Scoliosis or lateral curvature.
2. Posterior curvature, also known as kyphosis, gibbosity or excurvation.
3. Lordosis or anterior curvature.
4. Angular curvature from caries of the spine.

SCOLIOSIS.

This refers to a lateral deviation of the spinal column with or without rotation of the vertebræ on their vertical axes.

Scoliosis is the most frequent of all orthopedic affections

and is more common in girls than in boys (four to seven girls to one boy).

The largest percentage of cases occurs before the age of fourteen years and very few cases occur thereafter.

The most frequent curve is toward the right in the dorsal region, owing to the fact that the right is used more often than the left arm.

Scoliosis is usually acquired and the most frequent causes are general muscular debility and rickets.

Scoliosis may result from an empyema with adhesions and the concavity of the curvature is toward the affected side. Caries and spinal tumors may eventuate in scoliosis.

In SCIATICA, scoliosis is frequent, the body being inclined toward the healthy side (convexity of the spinal column toward this side) or, more rarely, the trunk is inclined toward the affected side, or even more rarely the trunk may alternate in being inclined toward one side and again toward the other side (alternating sciatic scoliosis). The probable cause of scoliosis in sciatica is unilateral reflex contractures of the muscles of the back.

Other varieties of scoliosis are:

1. HABIT SCOLIOSIS, due to habitual faulty positions, and in this category may be included vocational scoliosis resulting from faulty postures during occupation and observed in dentists, barbers, dressmakers and others.
2. STATIC SCOLIOSIS, due to inequality as a result of alterations in the extremity. Thus, in shortening of one leg an obliquity of the pelvis results in the opposite direction with a primary deviation of the lumbar vertebræ.

It is not difficult to recognize scoliosis when all the clothing is removed and the child stands. Scoliosis is made

evident by marking the spinous processes with an anilin pencil. Numerous scoliosometers are used for measuring and recording the degree of the deformity.

It may happen that in neurasthenics, the spines of the vertebræ are tender on pressure and here mistakes arise in the incorrect diagnosis of spinal caries. In the latter affection, spinal rigidity is the essential factor in diagnosis due in the early stages to involuntary muscular spasm and in the latter stages to ankylosis.

When the spine is flexible and curvature can be combated by manipulation, the case is one of scoliosis. Scoliotic curves however, may be rigid, but only after having been present for many years.

There are cases of functional lateral deviation of the spine which are easily corrected and must not be confused with true scoliosis. In the latter, flexion of the spine increases the deformity and in the former it is obliterated. Functional deviation, if neglected, may be converted into a true scoliosis.

Respecting prognosis in scoliosis one may say, that when there is no deformity of the bones, *i. e.*, when the physician can by traction and manipulation, correct the deformity, and when the spinal muscles are intact, a cure can be predicted. There is no antagonism between scoliosis and tuberculosis as was at one time supposed.

If scoliosis is caused by a shortened extremity, a thick-soled shoe is indicated. Muscular nutrition is effected by correct exercises, massage, electricity and central sinusoidalization (page 158).

KYPHOSIS AND LORDOSIS.

When the normal dorsal curve is increased it is known as kyphosis or posterior curvature, and increase of the

lumbar curvature is called lordosis, anterior concavity or saddle-back (Fig. 37). Compare the latter with Fig. 16 showing the divisions and contour of the normal spine.

Kyphosis and lordosis may co-exist. Lordosis is frequently an act of compensation to counteract the center of gravity going too far forward. This *compensatory lordosis* is noted in pregnancy, in obese individuals, from abdominal enlargement, in rickets, etc.

A paralytic variety of lordosis is observed in muscular atrophy and pseudohypertrophic paralysis.

FIG. 37.—A, increase of the dorsal curve or kyphosis; B, increase of the lumbar curve or lordosis.

Adolescent kyphosis is frequently noted in young women who have been overworked in the workshop or field.

As a rule, the deformity cannot be overcome by voluntary effort, and, in consequence of compensatory changes in the bones, it becomes permanent.

MUSCULAR KYPHOSIS may result from muscular weakness due to faulty attitudes and is observed in tailors, carpenters, shoemakers and others.

SENILE KYPHOSIS is caused by absorption occurring in the intervertebral discs.

RACHITIC KYPHOSIS is most pronounced in the lumbar region and disappears in the recumbent posture and in suspension.

In all recent cases of kyphosis, the deformity disappears when the patient lies upon the stomach.

Kyphosis is differentiated from the angular curvature of spinal-caries by the absence of rigidity of the spinal-muscles and pains when the vertebral column is percussed.

LUMBAR BULGING must not be confounded with kyphosis. It is usually a swelling on either side of the spine and is commonly associated with some renal affection (tumors, pyonephrosis, etc.).

ANGULAR CURVATURE.

This may result from any disease of the vertebral bodies, notably, tuberculosis, osteomyelitis, syphilis, secondary carcinoma of the vertebræ, etc. Insomuch as this condition usually results from tuberculous caries of the vertebral bodies, the reader is referred to the description of Pott's disease (page 108).

SPONDYLITIS.

Spondylitis deformans has already been described (page 106).

The vertebræ are implicated in various diseases usually of infectious origin. The following forms of spondylitis may be differentiated.

1. TRAUMATIC SPONDYLITIS.—This affection follows an injury and bears a close resemblance to Pott's disease. The vertebræ between the 3rd and 7th dorsal are most frequently implicated. The pain which is present may be located in the injured area or may be referred, and is accentuated by pressure and movements. Kyphosis may also be present. The injury may be associated with fracture and the spinal cord may be ultimately involved in this affection. Whereas traumatic spondylitis is non-tuberculous, it must not be

forgotten that Pott's disease may follow traumatism. In tuberculous disease of bone, here as elsewhere, the injury creates an area of least resistance in which the bacilli are deposited or a latent area of tuberculosis may be aroused into activity.

2. INFECTIOUS SPONDYLITIS.—This is observed in actinomycosis, syphilis, gonorrhea, osteomyelitis and typhoid fever (page 121).

SPONDYLOLISTHESIS.

This refers to a deformity of the spinal column produced by the gliding forward of the lumbar vertebræ in such a way that they overhang the brim of the pelvis and obstruct the inlet of the latter (spondylolisthetic pelvis).

It is an uncommon affection and results from malformation, strain or violence.

The diagnosis is established by:

1. A history of injury during the developmental period with pain in the lower part of the back.
2. Shortening of the body in the lumbar region.
3. Lordosis with separation of the ilia.

A like deformity of the pelvis known as SPONDYLIZEMA is produced by caries of the last lumbar vertebra and the top of the sacrum.

TRAUMATISM OF THE SPINE.*

It is an undeniable fact, that spinal injuries may prove an exciting factor in the development of many chronic diseases, notably, general paralysis of the insane, locomotor ataxia, etc.

Whether traumatism can be regarded as a cause of the latter affections is still a debatable question insomuch as

**Vide* litigation backs (page 97) and neurotic spine (page 103).

they may have existed unrecognized prior to the injury. Schlesinger, shows that the symptoms ascribed to a traumatic neurosis may be due in many cases to some pre-existing affection. He examined one hundred victims of various accidents within ten days of the accident and was amazed

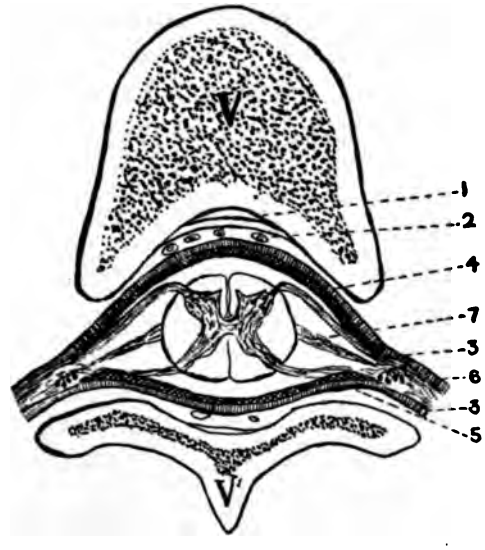


FIG. 38.—Relation of the spinal cord to the surrounding structures. V, body of vertebra; V', spinous process; 1, ligament; 2, vessels; 3, dura mater with the arachnoid lying directly beneath it; 4, anterior root; 5, posterior root; 6, spinal ganglion; 7, ligament (Dana).

at the large proportion of pathologic conditions found. Only twenty-two of the one-hundred persons were found normal.

It is likewise difficult to dissociate true from fictitious nervous symptoms following a simple strain which is often associated with the term traumatic lumbago (page 103).

A spinal sprain may result from direct or indirect injuries and the lumbar region is usually involved. According to the nature of the injury SPINAL SPRAINS may be differentiated as follows:

1. Simple sprain.
2. Sprain with nervous symptoms.
3. Sprain with spinal cord symptoms.

The relation of the spinal cord to the surrounding structures may be noted in Fig. 38.

A simple sprain is pathologically associated with some injury to the spinal-muscles and ligaments or both. The dominant symptom is pain moderated by rest and accentuated by motion. The spinal-muscles are in a condition of compensatory spasm to immobilize the vertebral column. Areas of tenderness may be present and simulation of pain may be excluded by the signs of Mannkopff and Loewi (page 70).

NERVOUS SYMPTOMS, usually neurasthenic or hysterical in character, may co-exist with the symptoms of a simple sprain and when cord-symptoms (paralysis, anesthesia, changes in the reflexes, girdle pain and sphincter-changes) follow the sprain, one must suspect concussion of the cord (when the symptoms abate within a week), hemorrhage within the cord (hematomyelia) or the development of a meningitis.

Simulation is a constant factor in spinal injuries and in diagnosis one must not forget Charcot's conception of a trauma in etiology. The latter taught that functional symptoms following an injury, were related to like symptoms which could be made to appear and disappear by hypnosis. The shock of an injury is tantamount to an hypnotizing agent (suggestion) which directs the attention of the patient to the injured part and suggests the symptoms (*traumatic suggestion*).

There are many neurologists who assume that the symptoms of a traumatic neurosis can be produced by one idea and removed by another idea, in other words, all is referred

to suggestion and that there can be no purely functional troubles in the absence of anatomic lesions.

OSTEOPATHIC TRAUMATISM.—In the author's experience, the mechanic manipulations of many osteopaths often conduce to severe spinal sprains for, if the osteopath regards a dislocated vertebra as the cause of disease or supposes that a vertebra is compressing a vessel or nerve, he is inclined to conciliate his conviction with more force than discretion.

TUMORS OF THE SPINE.

Tumors of the spine are usually carcinomatous and less frequently sarcomatous. Carcinomata are rarely primary. They are secondary in nature and due most frequently to metastases from carcinomata of the breast and occur therefore with greater relative frequency in women.

Secondary deposits in the lumbar spine are relatively frequent in individuals with cancer of the breast and a group of symptoms designated by the term *paraplegia dolorosa* accompany the deposits, viz., lancinating pains, hyperesthesia and occasionally paralysis of the bladder and rectum.

In malignant disease of the spine the following are characteristic signs: rapid course, cachexia, local tenderness and severe pain, deformity, rapid emaciation and anemia, absence of fever, paraplegic symptoms, antecedent history of a malignant growth and localization in the lumbar region.

The iso-hemolytic power of the serum may yet serve of diagnostic value as a characteristic reaction of cancer.

TYPHOID SPINE.

Bone-lesions (periostitis, caries and necrosis) are occasional sequelæ of typhoid fever.

In 1889, Gibney described a condition of the spine

occurring during the course of the disease in protracted cases and more often during convalescence, in which pain is felt either in the lumbar or sacral regions, especially after a slight injury or shock. Usually the condition is a neurosis with a good prognosis, but in rarer instances, the pathologic process may be a periostitis with or without a subperiosteal abscess or spondylitis.

Among the symptoms are stiffness, localized pain and weakness of the back.

The total number of cases thus far reported is about seventy-four.

VERTEBRAL INSUFFICIENCY.

This condition has been described by Schanz in individuals between the ages of 20 and 40 years who complained of severe pains in the back. The spinous processes of the vertebræ are painful on percussion and the bodies of the lumbar vertebræ are equally sensitive. The latter is demonstrated by deep abdominal palpation when the fingers attain a point where the pulsations of the abdominal aorta are perceptible. Another sign is the difficulty experienced in changing the dorsal for the ventral posture.

Vertebral insufficiency is frequently regarded as an expression of neurasthenia and often it has been misinterpreted as a tuberculous spondylitis, but the immediate results of the treatment exclude neurasthenia and spondylitis. Some of the patients date the symptoms from the moment corsets have been discarded. The treatment consists of rest, massage and particularly the use of an orthopedic corset.

ORTHOSTATIC ALBUMINURIA.—In this affection, which occurs most frequently in children, albuminuria is present when the patient is up and about but disappears after rest in bed. The condition is not associated with nephritis.

Jehle[39] regards *lordosis* as an invariable concomitant of this condition and he has induced albuminuria in healthy children by provoking a curvature of the spine. It is supposed that the incurved vertebræ protrude into the space between the kidneys, thus twisting them around on a vertical axis and causing circulatory disturbances. It is further assumed that when the children are up, the weakness of the spinal muscles causes a lordosis. The albuminuria may be corrected by a supporting corset or by strengthening the muscles of the back and by making the sole of the shoe a little thicker.

MAL-ALIGNMENT OF THE CERVICAL VERTEBRAE.[51]

As observed on page 42, our conception of the movements of the spine is too limited and if the current opinion is entertained, that the vertebræ are firmly bound together to form an elastic whole or entity, it is impossible to credit such a condition as mal-alignment of the cervical vertebræ without the presence of a traumatic dislocation.

Bates[51] observes, "the muscles are designed and attached to each vertebra so as to enable it to contribute its proportionate share to any of the movements of the neck as a whole, and this arrangement guarantees it a certain amount of individual mobility; which is needed for the execution of the more complicated motions of the head and neck."

Reference has been made on page 47 to the author's observations on spasm of the spinal musculature provoked by peripheral sources of irritation. The muscles, in a condition of spasm by exercising traction on the cervical vertebræ, may force them out of the normal alignment.

Now the osteopath contends that, in consequence of the spasm of the muscles and mal-alignment of the vertebræ,

compression of the vessels and nerves ensues which conduces to definite systemic anomalies.

The recognition of cervical spasm and mal-alignment is not difficult. The former may be recognized by palpation; the muscles are painful and in a condition of contraction.

Mal-alignment is noted by deviations from the normal articular line of the head and vertebral column.

Dr. Geo. Gould comments on the frequency of mal-position of the head, torticollis and spinal curvature due to eye-strain.

The author has noted even in the norm that, when the physician directs a patient to make strained movements of the eyes (without moving the head), and at the same time palpates the muscles of the neck on either side of the spine, the muscles in question contract spasmodically. It is not difficult to conceive then that, if the peripheral irritation is persistent, the muscles can pass into a state of tonic contraction.* Now a bit of conservatism is necessary in estimating the results attained in the treatment of these cases. It is difficult to conceive, at least, theoretically, how any manipulation of the muscles will bring benefit until the source of peripheral irritation is eliminated. However, one must regard with tolerance the observations of those who contend that relaxation of the contracted muscles and releasing "locked out vertebræ" suffice to cure.

For the sake of completeness, the author desires to describe the methods employed by osteopaths for the "adjustment of muscular lesions" and the "adjustment of cervical vertebræ.[2] "

*Dr. Louis C. Deane, recently referred a patient to me for diagnosis, who in consequence of a severe injury to the head, suffered from diplopia and vertigo. The condition was one of muscular asthenopia. In this patient the muscles of the neck were in a state of tonic contraction and the head almost approximated the shoulder. Suggestion made during hypnosis sufficed to remove the diplopia after a single séance and when corrected the head was again held in a normal position.

ADJUSTMENT OF MUSCLES.

1. Pressure with quiet and slight rotation usually in a direction at right angles to that of the muscular fibers.

2. Relaxation is attained by stretching the muscle with the object of separating the origin and insertion of the muscle.

3. By approximating the origin and insertion of the muscle.

The foregoing methods are infrequently employed alone, but are usually used in combination.

ADJUSTMENT OF CERVICAL VERTEBRAE.

1. With the patient in the recumbent posture, the physician at the head of the table grasps with the fingers of each hand the tissues along the region of the arches of the vertebræ with the thumbs on the transverse processes; the lesion is exaggerated by pushing with the left hand directly to the right the tissues overlying the lateral arches; simultaneously the patient's head is forced against the abdomen of the physician to steady the movement. Next, reverse pressure is applied over the right lateral arch and rotation is achieved by movement of the hands and body of the physician.

2. With the patient in the same position as in the foregoing method, pressure is effected after the same manner but the fingers on one side and the thumb on the opposite side grasp the postero-lateral arches and with the hand upon the crown of the head, manipulation is made for purposes of rotation. Pressure is made downward upon the head in the direction of the axis of the vertebral column so as to fully relax the muscles and other tissues.

CONGESTION OF THE SPINAL CORD.

According to some authorities, areas of *vertebral tenderness* are associated with congestion of the spinal vaso-motor centers. The pathologist, however, is unable to confirm this clinical observation. On the contrary, anemia does cause changes in the cell-bodies of the cord with degeneration. It is an undeniable fact that, any interference with the motions of the spine resulting from weakness of the spinal musculature is associated with venous stasis which must necessarily interfere with the nutrition of the cord. The spinal muscles in the lumbar region are supplied by the lumbar arteries and in the dorsal region by the intercostal arteries. Branches from these vessels enter directly into the spinal canal on a level with each vertebra.

The SPINAL VEINS have no valves. The venous plexuses upon and within the spine are as follows: 1. Those placed on the exterior of the column (dorsal spinal veins); 2. Those located in the spinal canal between the vertebræ and the membranes (meningo-rachidian veins); 3. The veins of the vertebral bodies; 4. The veins of the spinal cord (Fig. 39).

DIAGNOSIS OF SPINAL DISEASES.

In the differential diagnosis of spinal diseases the genesis of PAIN* and DEFORMITY must be determined. Then one must decide if the membranes and spinal cord are implicated and also the character of the lesion. The following tables will aid in the differentiation of pain and deformity.

**Vide* backaches and lumbago (pages 83 and 99).

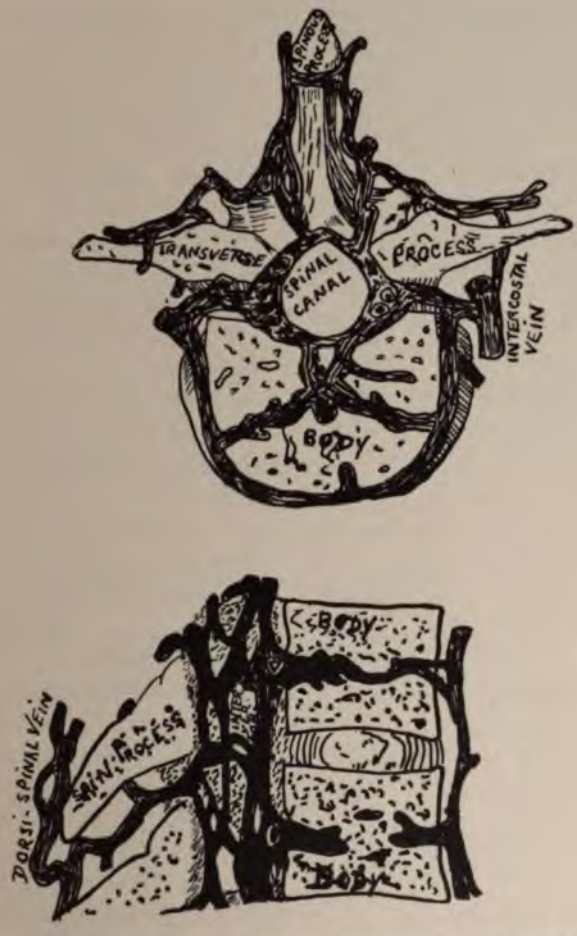


FIG. 39.—The upper figure represents the transverse section of a dorsal vertebra showing the spinal veins. The lower figure is a vertical section of two dorsal vertebræ showing the spinal veins.

PAINS.

DISEASE.	CONCOMITANT SYMPTOMS.
ANEURISM (thoracic).	Sharp paroxysmal lancinating pains when the aneurism erodes the vertebræ. Pain radiates down the left arm, to neck and upper intercostal nerves. Also anginoid pains. Signs of intrathoracic pressure. In spinal curvature, dislocation of the heart may cause displacement of the aorta, causing the latter to pulsate to the right of the sternum.
COMPRESSION MYELITIS.	*Nerve-root symptoms.*—Radiating pains, anesthetic areas, trophic disturbances and atrophy of the muscles. *Cord symptoms.*—Cervical reigon—Retropharyngeal abscess, spasm of the cervical muscles, dilatation of the pupil and unilateral flushing or sweating. *Thoracic region.*—Paraplegia of the spastic type (exaggerated reflexes) and when the compression is complete (rare), reflexes are abolished. *Lumbar region.*—Paraplegia with implication of the sphincters.
HIP-JOINT DISEASE.	Often confounded with lesions of the lumbar region. Pain in hip, front of thigh, or at inside of knee. Limitation of motion of the hip-joint, unilateral atrophy of the muscles (especially the adductors), lameness, swelling

DISEASE.	CONCOMITANT SYMPTOMS.
	confined to the front and back of hip-joint and attitude of limb (abducted and everted).
INTRASPINAL TUMORS.	Symptoms vary with the segment involved. Radiating pains from the level of the lesion. Usually paralysis of the leg on one side and sensory disturbances on the opposite side and jerking movements of the lower extremities. A radiogram may show infiltration of the vertebræ by the growth. At the level of the growth, pressure at the side of the spinous processes may elicit the pains felt by the patient.
LATERAL CURVATURE.	Severe cases in the lumbar region may simulate malignant disease of the spine. The latter is excluded by the long duration of the disease absence of cachexia, presence of compensatory curves and the unilateral deformity.
LEUKEMIA.	The sternum and spinal column are exquisitely tender on pressure.
LUMBAGO.	Usually occurs after a sudden muscular effort in a gouty or rheumatic subject or after exposure to cold or wet. Patient usually in excellent health and pains yield as a rule to treatment. Lumbago resisting treatment may be symptomatic of an organic lesion of the spine (Pott's disease, tumors).

DISEASE.	CONCOMITANT SYMPTOMS.
LOCOMOTOR ATAXIA.	Lightning pains usually of a few seconds duration are most common in the legs and about the trunk. History of syphilis, ataxia, absence of knee-jerk, Argyll-Robertson pupil and sensory disturbances in the legs.
NEUROMIMESIS (Hysteria).	The spinal symptoms (spinal irritation) of hysteria and neurasthenia may simulate locomotor ataxia. The spinal tenderness is general, the pains are fugitive and evanescent and are not limited to definite anatomic territories. The patients are usually women and the history is corroborative.
OSTEOARTHRITIS.	*Vide* spondylitis deformans (page 106).
OSTEOMYELITIS.	Local symptoms of swelling and rigidity of the spine, constitutional symptoms of sepsis, sudden in onset and suppuration always occurs. Usually secondary to some distant suppurative focus.
PLEURODYNIA (Muscular rheumatism of the intercostal muscles, pectorals and serratus magnus).	Pain usually on left side and accentuated by breathing and coughing. Affected muscles painful on pressure. Often mistaken for pleurisy and intercostal neuralgia (page 186).
SCIATICA.	A bilateral sciatica is always suggestive of a cord-lesion, notably pressure on the nerve-trunks of the cauda equina. Sciatica is

DISEASE.	CONCOMITANT SYMPTOMS.
	often secondary to a chronic arthritis of the spinal column and may be unilateral in the lumbo-sacral roots in Pott's disease.
SPINAL MENINGITIS.	The root-pains are often confounded with Pott's disease. In the latter disease, the root-pains are relieved by rest and accentuated by movement and the erect posture. In meningitis, there is a lymphocytosis of the cerebro-spinal fluid, whereas in Pott's disease (tuberculosis outside of the membranes) the fluid is normal.

DEFORMITY.

DISEASE.	CONCOMITANT SYMPTOMS.
ACROMEGALY.	This dystrophy manifested by hypertrophy of the bones of the face and extremities is characterized by kyphosis.
ANEURISM.	Deformity due to eroding into the bodies of the vertebræ occurs late in life and other symptoms of aneurism co-exist.
CHONDRODYSTROPHIA (Fetal rickets).	Rigid kyphosis without spasmodic muscular contraction. Deformity of the chest and premature ossification of the epiphyses of extremities.
MALIGNANT DISEASE OF THE SPINE.	Deformity absent or rounded without bursa. No suppuration, rapid course, cachexia, severe localized pain and paraplegia.
OSTEOMYELITIS (vertebral).	Acute onset, rapid suppuration, constitutional signs of sepsis and rigors.

DISEASE.	CONCOMITANT SYMPTOMS.
PAGET'S DISEASE (Osteitis deformans).	The dorso-cervical kyphosis is associated with forward projection of the head, prominent clavicles, triangular-shaped face and shortening of the stature.
POTT'S DISEASE (caries).	Kyphosis is sharp and angular and usually gradual in development with muscular rigidity of the spine. Kyphosis as a rule, when not due to caries, shows soft erector spinæ muscles and the absence of pain on concussion transmitted to the back.
PULMONARY OSTEOARTHROPATHY (Hypertrophic).	Kyphosis may be present. Enlargement of the articular ends of the bones, enlarged terminal phalanges and incurvation of the nails. Usually associated with pulmonary diseases.
RICKETS.	Kyphosis most pronounced in lumbar region and disappears in recumbency and suspension. Other signs: open fontanels, enlarged abdomen, rachitic rosary, enlarged epiphyses and deformity of the long bones.
SCURVY (Barlow's disease).	Kyphosis is not frequent in infantile scurvy and is associated with other joint-lesions, swollen gums, ecchymoses, swelling of the epiphyseal junctions and pain on moving legs and thighs.
SENILITY.	Kyphosis occurs in elderly persons from flattening out of the vertebral discs from pressure

DISEASE.	CONCOMITANT SYMPTOMS.
SPONDYLITIS DEFORMANS (Rheumatoid arthritis).	Occurs late in life with stiffness and arching of the spine without kyphosis, muscular spasm and suppuration.
SYPHILIS.	Congenital and acquired syphilis by causing kyphosis may lead to the erroneous diagnosis of Pott's disease, but syphilitic and not tuberculous symptoms are present.

COMPRESSION OF THE SPINAL CORD.

(COMPRESSION MYELITIS).

Spinal diseases may, or may not, be associated with interruption of the functions of the cord by slow compression.

Among the causes of compression are the following:

1. Caries (Pott's disease).
2. Malignant growths (vertebral and retroperitoneal).
3. Aneurisms.
4. Syphilis.
5. Trauma.
6. Parasites in the spinal canal (echinococcus and the cysticercus).

The symptoms of compression are:

1. VERTEBRAL.—Spinous processes tender on pressure, muscular rigidity of the spine and pain. The latter is accentuated when the spine is concussed or twisted.

Kyphosis associated with vertebral disease is rarely the cause of compression, for the reason that the latter is more often the result of inflammation of the spinal meninges and the presence of inflammatory products between the involved vertebræ and meninges. The relation of the spinal cord to the surrounding structures is shown in Fig. 38.

2. NERVE-ROOT SYMPTOMS.—Caused by compression of the nerve-roots as they emerge between the vertebræ and consist of pains in the region innervated by the nerves whose roots are compressed.

Additional symptoms are: Sensory and trophic disturbances, herpes; and when the ventral roots are compressed, there is wasting of the muscles supplied by the affected nerves.

3. CORD-SYMPTOMS.*—They are dependent on the region involved.

i. CERVICAL REGION.—Retropharyngeal abscess, spasm of the cervical muscles, dilatation of the pupils, unilateral sweating and flushing of the face and paralysis of all four extremities.

ii. THORACIC REGION.—Disturbances of sensation in the lower extremities, girdle sensations and pains in the course of the intercostal nerves and paraplegia (usually spastic) with exaggerated reflexes.

iii. LUMBAR REGION.—Paraplegia without exaggerated reflexes and involvement of the bladder and rectum.

PARAPLEGIA.

This is a symptom of many special diseases and may require a careful differentiation. Following a TRAUMA, it occurs almost instantly or it may be partial and in the course of a brief period it may be complete as a result of a destructive hemorrhage or from additional laceration of the cord from a fractured vertebra.

The paraplegia associated with the following affections demands differentiation:

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*The site of the lesion is easily determined (page 30).

1. Rickets.
2. Barlow's disease.
3. Syphilis.
4. Hysteria.

i. RICKETS.—The pseudo-paresis of this disease results from muscular weakness plus the pain caused by movements of the extremities. The muscles may atrophy from disuse, but there is no *reaction of degeneration*. The latter is also absent in cerebral paralyses but the reflexes are exaggerated and there are brain-signs and spasticity of the extremities.

ii. BARLOW'S DISEASE (infantile scurvy).—The pseudo-paralysis of this affection is likewise caused by muscular weakness and pain as well as by the subperiosteal extravasation of blood which causes tenderness in the shafts of the bones. Scurvy and rickets may co-exist. In both affections the electric reactions are unaltered. In scurvy, antiscorbutic treatment (fresh cow's milk, meat-juice and orange-juice or lemon-juice) yields prompt results and, in this sense, it is equally diagnostic and curative.

iii. SYPHILIS.—In children there is a syphilitic pseudo-paralysis known as Parrot's disease, in which sudden loss of motion may occur in either the lower or upper extremities or both and is caused by a separation of the cartilage at the end of the bone. Crepitation and pain follow movement of the affected extremity.

iv. HYSTERIA.—The disturbances of motility are essentially paralyses of function or will-power.

In one class of cases, movements like standing and walking are impossible, whereas all other functions may be executed by the same muscles. The reflexes are intact or exaggerated, the electric reactions are normal and there is no muscular atrophy. Symptoms of the bladder common in organic paraplegia are usually absent in the hysterical form.

If the affected muscles offer any resistance to passive movements, it is suggestive of hysteria.

HOOVER'S SIGN for the detection of malingering and functional paralysis of the lower extremities is as follows: In the norm, when a person lying on a couch on his back is requested to raise the right foot off the couch with the leg extended, the left heel digs into the couch as the right leg and thigh are elevated; in other words, the left heel is used to fix a point of opposition.

If a normal person is requested to press the right leg against the couch there will be a counter-lifting force shown in the left leg. This complemental opposition is present in the norm and in genuine paresis or paralysis (even though feebly expressed) but its absence in the malingerer and in hysteria signifies the existence of cerebral inhibition.

The sign of Beevor[30] is based on the fact that, in functional paralysis the patient is unable to inhibit the antagonistic muscles. This condition is often noted in the knee and for this purpose the patient lies with the face downward and the leg is put up at right angles to the thigh and the patient is directed to extend the knee against resistance. In the norm the hamstrings should be relaxed at once, but in functional paralysis these muscles can be seen and felt to contract along with the extensors. The limb must be fixed and prevented from moving, otherwise as the joint is extended or flexed, the antagonists may be passively drawn on and give the impression that their muscles are actively contracting.

Anesthesia from the waist downward without involvement of the genitalia is usual. The latter condition may be reversed; anesthesia of the genitalia, whereas the other parts may retain their sensibility.

According to Kahane, neuroses are favorably influenced

by the high-frequency current, whereas hysterical subjects react unfavorably and new symptoms are added to the old ones even after a single application. In fact, latent hysteria has been detected after this manner.

NATURE OF THE LESION.

TUBERCULOSIS.

Respecting the relative frequency of tuberculous joint-disease, the following statistics of Young[31] are apposite:

Vertebræ	46.7	per cent.
Hip	34.4	"
Knee	12.2	"
Ankle	5.1	"
Elbow	0.8	"
Shoulder	0.5	"
Wrist	0.3	"

In etiology, a history of heredity is important. Acquired predisposition is developed in consequence of conditions which diminish resistance and predisposition to tuberculosis.

Environment is a cogent predisposing factor. The absence of sunlight and fresh air predispose to infection.

During the first decade of life, the bones, meninges and lymph-glands are more frequently involved. A surgical operation may convert a localized into a generalized tuberculous process, notably, acute miliary tuberculosis.

As a rule, practically all tuberculous joint-lesions are referred to some injury and all authors agree that only mild injuries result in tuberculosis.

In severe traumatism, the process of repair is so active that the tubercle bacilli are destroyed. Experiments by inoculation confirm the latter clinical observation. Thus Krause, after inoculating animals with tuberculous material and then contusing the joints, obtained typical joint-lesions.

If, however, the traumatism were severe there was no secondary involvement of the joint.

Tuberculous involvement of the vertebræ usually occurs during childhood (before the age of 14 years).

Several joints may be simultaneously involved in tuberculosis, notably, the hip and spine and the knee and spine.

Asthenia, fever, night-sweats and emaciation are the characteristic symptoms of tuberculous infection. The x-rays may prove of some value in early diagnosis, but as a rule, the skiagram only demonstrates lesions which have attained some magnitude.

Respecting the diagnosis of tuberculous lesions by aid of TUBERCULIN, the latter can only prove of value as a negative test (showing the absence of tuberculous foci in the body) and rarely as a positive test, owing to the fact, that vertebral involvement is usually secondary to a tuberculous lesion elsewhere in the body.

The reaction with tuberculin is based on the fact, that in tuberculosis the tissue-cells develop a hypersensitiveness to the poisons of the tubercle bacillus (*allergistic reaction*).

In cachectic individuals, in acute tuberculosis, and in all those far advanced in the disease, tuberculin tests are usually negative owing to the fact, that the organism is so overwhelmed by the poisons that it is unable to react.

The tuberculin test may at first be negative, but when repeated it is positive. In such instances it is assumed, that there are latent tuberculous foci which have not been in contact for a long time with the poisons of the tubercle bacillus and that the first test stimulates immunization which favors a reaction when the subsequent test is applied. A positive reaction with the subcutaneous method is obtained in from 50 to 80 per cent of clinically healthy individuals.

In the presence of fever, the cutaneous or conjunctival

method is preferable to the original hypodermic method. In the latter the puncture-reaction (red area of infiltration, edema and pain at point of puncture) is even more diagnositc that the febrile reaction. The MORO TEST is harmless and consists of rubbing into the unbroken skin of the abdomen a mixture of equal parts of tuberculin (old) and anhydrous lanolin. The rubbing should continue for about two or three minutes. The reaction, if positive, is manifested in from 12 to 48 hours after the inunction by small papules and redness of the anointed area. The latter reaction is fairly reliable.

The presence of tubercle bacilli in the circulating blood in tuberculosis, demonstrable after the simple method of Rosenberger,[33] may prove of greater value in diagnosis than the tests with tuberculin. Many authorities, however, have been unable to confirm the observations of Rosenberger.

Snow, finds that the employment of the *static current* gives prompt relief in non-infected joint-conditions, but produces negative results or aggravates the condition in tuberculous infections.

SCROFULA is an attenuated tuberculosis of the lymph-glands and practically in all cases of acute tuberculosis the source of infection is from unhealed foci in lymph-glands (tuberculous adenitis).

SYPHILIS.

Tardy hereditary syphilis of the bones may occur in adults, but is most frequent between the ages of 6 and 10 years.

The pains of this affection may be regarded as rheumatic and the associated syphilitic fever may suggest typhoid fever.

The bones of the extremities are notably involved, usually at the shafts or in juxtaposition to the articulations, and swelling and deformity ensue. The tibia is most frequently

implicated, resulting in a forward projection of the bone (saber-bladed deformity). The surface of the bone may show irregularity due to the presence of nodes.

Syphilis of the spine resembles Pott's disease.

The following signs of congenital syphilis suggest the diagnosis:

1. Nasal catarrh (snuffles).
2. Depression at root of the nose.
3. Cutaneous lesions.
4. Fissures at the angles of mouth (rhagades).
5. Alopecia (hair of head and eyebrows).
6. Tardy development (infantilism).
7. Deformed teeth.
8. Interstitial keratitis.
9. Ear-affections.

The therapeutic test is fairly conclusive if employed with circumspection. Here nutrition must be maintained to get the best results.

Syphilis with lesions of the bones responds favorably to Gibbert's syrup:

Biniodid of mercury	1 grain.
Potassium iodid	½ ounce.
Water	2 ounces.

Dose.—Five to ten drops three times a day gradually increased and continued for months.

The Wassermann reaction is extremely valuable in the diagnosis of syphilis, but the reaction is too complicated for the practitioner and in consequence has been supplanted by the simplified method of Noguchi[37]: To 0.1 c. c. of spinal fluid in a tube of not over 1 cm. diameter, add 0.5 c. c. of 10 per cent butyric acid; heat till bubbling and while hot add 1 c. c. of 4 per cent sodium hydrate solution. The fluid becomes flocculent in a few moments, whereas normal fluids are only opalescent or cloudy.

GONORRHEA.

Many obscure bone-lesions incorrectly diagnosed as rheumatism owe their origin to the gonococcus, the result of systemic gonorrheal infection.

Gonorrheal arthritis is characterized by involving joints which are not usually implicated in acute rheumatism, viz., sacro-iliac, intervertebral, temporo-maxillary and sterno-clavicular articulations.

A history of gonorrhea suggests the character of the lesion.

The employment of a gonococcic vaccine[34] promises to prove of diagnostic value in gonococcic infections. The gonococcus reaction usually appears in from 8 to 12 hours after the injection and lasts about 24 hours. The most constant feature of the reaction consists of an increase of pain and tenderness in the affected joints and a slight pyrexia following the injection.

It is well to recall the remarkable cures of gonorrheal arthritis reported by Fuller, who insists that the infectious material is derived from a gonorrheal vesiculitis and by opening and draining immediate relief of the arthritis occurs.

RHEUMATISM.

An acute *arthritis deformans* may be mistaken for acute rheumatism and the diagnosis is often established when the affection has lasted for weeks and with subsidence of the fever, periarticular indurations and deformities persist.

Implication of the smaller joints and the early deformities exclude acute rheumatism.

An acute *osteo-myelitis* may also be confounded with rheumatism, but the following signs are characteristic of osteo-myelitis:

1. It is most common in infants or children, *i. e.*, during the period of active growth of bone.
2. Severe constitutional symptoms of septic absorption.
3. Involvement of the epiphyses rather than the joints.
4. The condition is sudden in onset and pus forms rapidly.
5. In osteo-myelitis of the vertebræ angular deformity is rare (differentiation from Pott's disease).

The use of salicylates is a valuable aid in diagnostic pharmacotherapy. Failure in the treatment of rheumatism with the salicylates frequently results from their faulty administration. The usual doses are absolutely inadequate.

If sodium salicylate is given at regular intervals until its physiologic action is manifested (tinnitus or deafness), then stopping its use and resuming it when the latter have abated, usually on the second day there is a decided fall of temperature and relief from pain in acute rheumatism. The joint-swelling usually disappears by the fourth day.

McCrae and Clarke have directed attention to the diagnosis of various forms of arthritis by the use of salicylates. The true rheumatic can tolerate from 150 to 300 grains of sodium salicylate before toxic symptoms occur, whereas in other forms of arthritis such symptoms develop after smaller doses. Thus in *gonococcic arthritis*, the average amount to produce toxic symptoms was 131 grains.

In true rheumatism, the fever, pain and swelling disappear in two or three days, whereas in other forms of arthritis, while the temperature may fall to normal, there is no change in the swollen joints. Doctor Lees, in a paper contributed to the Proceedings of the Royal Medical Society, also believes, that in most instances where the salicylates fail to relieve arthritis, the condition is not one of acute articular rheumatism but of some other form of infection.

Rheumatism *in children* is unattended by typical joint-symptoms and a heart-lesion may be the only manifestation of the disease. The following signs may also suggest the disease in children: tonsillitis (initial symptom), growing pains, chorea, myalgia, pleurisy, frequent attacks of bronchitis and anæmia. In children the salicylates must likewise be given in large doses: For a child of from 7 to 12 years, from 10 to 100 grains daily, and for a child under 7 years, from 5 to 50 grains daily, with twice the amount of sodium bicarbonate in each case. The latter drug is employed to counteract the toxic symptoms of the salicylates. In all cases when the salicylates are given in large doses one must carefully watch for the development of drowsiness, acetone odor of the breath and disturbances of the respiration.

RICKETS.

The associate symptoms of this affection are diagnostic;

1. During incubation, local sweatings (head and neck) and nocturnal fever preceding the period of bone-change.

2. Deformation of the bones is marked by hyperesthesia or tenderness of the latter and pain on voluntary movement.

3. Deformity of the thorax; changes in the epiphyseal junction of the ribs (rachitic rosary, characterized by a series of bead-like enlargements); pigeon-breast or chicken-breast.

4. Deformity of the spine, exaggeration of the normal curves, scoliosis and lordosis, which are accentuated by the large size of the abdomen.

5. Deformity of the head: oblong or square head, anterior fontanel open (closed in the norm about the 18th month); softened spots in the occiput (cranio-tabes), early decay of the teeth and retarded cerebral development.

6. Deformity of the extremities: an increase in the size of the epiphyses (wrist, elbow, ankle, knee) which suggests

a joint (hence the popular expression "double-jointed") and bending of the long bones.

Recovery may occur within a few months, the bones remaining thick and hard with firm and short muscles and partial disappearance of the deformities.

SPINAL MENINGITIS.

A chronic meningitis may be confounded with a tumor of the spinal cord or disease of the vertebral column and Horsley[35] has seen a number of such cases which he has treated by laminectomy, opening the theca and washing it out with a mercurial solution.

The cases occur most often in adults with syphilis or gonorrhea as possibly etiologic factors.

In differential diagnosis the following points are of value: A tumor of the cord exhibits pain usually localized to one nerve-root, but in meningitis, the pains spread gradually to the front and back of the thigh and cause painful cramping and twitching of the muscles of the right leg. Other signs are tightness and numbness of the thigh and a progressive loss of power in the legs eventuating in a progressive paraplegia.

CHAPTER V.

GENERAL SPONDYLOTHERAPY.

ABDOMINAL SUPPORTERS — ACUPUNCTURE — COUNTERIRRITATION — ELECTROTHERAPY—EXERCISES—RE-EDUCATION OF CO-ORDINATED MOVEMENTS—SPINAL HYDRO-THERAPY—LUMBAR PUNCTURE — MASSAGE — PSYCHROTHERAPY — THERMOTHERAPY — VIBRATORY MASSAGE.

ABDOMINAL SUPPORTERS.

Reduced intra-abdominal tension conduces to a condition described by the author as *intra-abdominal insufficiency*, and the latter contributes to a group of symptoms made up of backache and neurasthenia.

Minor grades of insufficiency may be detected by the following signs, which the writer has described more fully elsewhere:[38] first, auscultate the heart-tones, palpate the pulse, determine blood-pressure and define by percussion the borders of the heart and the upper border of the liver while the patient is standing. Next, direct an assistant standing behind the patient to firmly and forcibly lift the abdomen, exerting the pressure in a direction upward and inward. While the latter pressure is maintained, the foregoing methods of examination are again executed and if abdominal tension is reduced the following are noted: the heart-tones become stronger, the pulse fuller, the blood-pressure augmented from 5 to 30 mm. and the percussion areas of the heart and liver become higher and more pronounced.

The heart is prolapsed (cardioptosis) as well as the liver in diminished abdominal tension.

The author has frequently noted a systolic aortic murmur when the abdomen was pendulous which disappeared during

the time the abdomen was raised by an assistant and reappeared when the abdominal wall was dropped. This murmur is probably caused by traction on the aorta by a prolapsed heart, the result of an intra-abdominal insufficiency.

Many of the local symptoms of reduced abdominal tension are at once relieved by raising the abdomen in the manner suggested and if an abdominal support is employed, its value may be tested by noting the effects on the pulse, blood-pressure and position of the heart before and after its application.

Those who object to mechanic supports will find in the method of Kellogg, an excellent means of strengthening the abdominal muscles and thus securing a natural increase of intra-abdominal tension; the electrodes of a sinusoidal current are placed on either side of the spine about four inches apart and just below the inferior angles of the scapulæ. When the current is sufficiently strong, all the abdominal muscles will be thrown into vigorous contraction.

ACUPUNCTURE.

The author has already portrayed his conception of many diseases as expressed in the antagonism of muscles (page 11). This theory is in accord with our percutaneous methods of treatment and refers with special cogency to spondylotherapy. In the foregoing pages the following fact has been elaborated, viz., that throughout the spinal region one may arouse definite reflexes and that every reflex has its counter-reflex. Thus our therapy by peripheral methods resolves itself into the following: either an abnormal reflex is inhibited or it may be antagonized by a counter-reflex. In a word, peripheral stimulation signifies irritation of centrifugal or centripetal nerves. In arousing the former

to activity we stimulate motor, secretory, trophic, inhibitory and thermic nerves, whereas stimulation of the centripetal nerves predicates an action on the reflex-motor, reflex-secretory and reflex-inhibitory nerves.*

Lumbago (*myalgia lumbalis*), may be confounded with many reflex troubles and affections of the vertebral column. If the lumbar pains originate in the muscles alone, acupuncture, by its almost miraculous curative action, is diagnostic of lumbago.

The method may be made painless by local anesthesia before ordinary sterilized bonnet-needles are forced into the painful points of the lumbar muscles and allowed to remain for about ten minutes. It may be necessary to repeat the manœuver. A number of smaller needles may be passed through the skin into the muscular tissue. The method is equally efficacious in the treatment of myalgias elsewhere and appears to be more successful in those who have bilateral pain.

Sir James Grant supposes that the needles set free an excessive storage of electricity which has accumulated in the muscles.

An intramuscular injection of morphine (1-6 grain) and-atropin (1-60 grain), or a few minims of chloroform, may also give immediate relief, but here it is difficult to differentiate the action of the medicament and the acupuncture.

*The excitability of certain nerve-centers is diminished by calling other centers into action. Franck, in the "Dictionnaire Encyclopédique des Sciences Médicales" observes, that when one considers the normal functions of the nervous system, one finds that there exists a necessary equilibrium between the different parts of this system. This equilibrium may be destroyed by the abnormal predominance of certain centers which seem to divert to their own advantage too great a proportion of the nervous activity; thus, the functions of the other centers appear to be disturbed. The *ankle-clonus* depends on an exaggerated excitability of the calf muscles. If now, I excite with the sinusoidal current the spinal segment (page 30) presiding over the muscles which antagonize the calf muscles, for a time, at least, the ankle-clonus can no longer be elicited. This method has been employed successfully by the author in overcoming spasms of definite groups of muscles.

COUNTERIRRITATION.

Counterirritants are valuable agents for the relief of pain if applied in correct situations. As we will notice in the subsequent chapter on PSEUDOVISCERAL DISEASES, the pains usually experienced in the thoracic and abdominal walls are

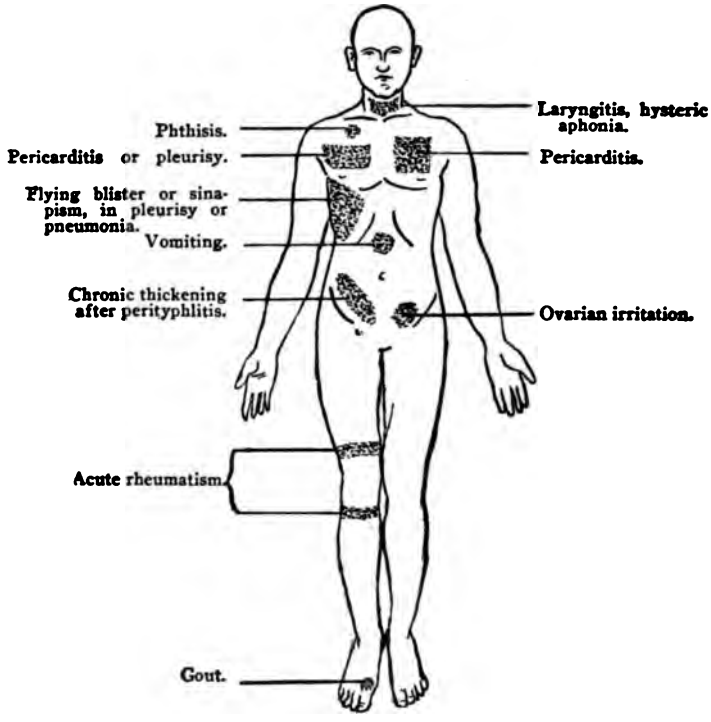

FIG. 40.—Diagram of the body showing some of the areas where counterirritants are usually applied. Front view.

pains referred to the periphery, whereas the actual site of the lesion is alongside of the spine at the vertebral exits of the affected nerves. It is evident then, that if the counterirritant is applied at the point where the pain is felt rather than at the site of the lesion, no result is achieved. It was the custom of Trousseau to trace a neuralgia along the course

of a nerve to the spine from which it made its exit, at which site the painful point was blistered.

In diseases of the hip, pain is felt in the knee, yet the

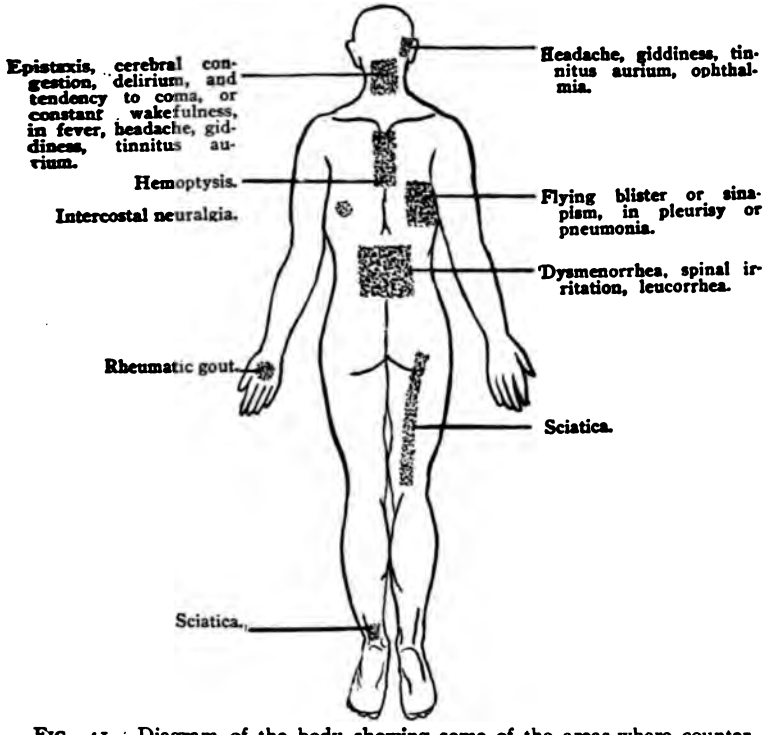

FIG. 41.—Diagram of the body showing some of the areas where counter-irritants are usually applied. Back view.

counterirritant, to be effective, must be applied to the hip.

Insomuch as counterirritants achieve their analgesic effects by influencing the distribution of blood in a part either reflexly through changes in the caliber of the vessels or by anemizing the morbid structures, *leeching and cupping* may, in many instances, achieve like effects. It may be necessary in some instances to accentuate counterirritation and for this purpose an escharotic or the actual cautery is used.

The observation of Head (page 58) shows that the viscera and definite areas on the surface of the body receive their nerve-supply from the same segment of the spinal cord and that irritation of the one reacts favorably upon the other.

It will be noted in the accompanying figures (40 and 41) from Brunton, that the areas established empirically for applying counterirritants to influence the viscera nearly correspond to the dermatomes of Head.

Nothing in my experience equals freezing (*vide* psychrotherapy) for the purpose of counterirritation in spondylotherapy and for this reason, I employ freezing to the exclusion of all other methods.

Cantharides is the usual vesicant employed, although many preparations on the market are useless. Before applying cantharidal collodin or a plaster, wash with soap and water and then dry the skin thoroughly with alcohol and if a plaster is used, moisten it with a few drops of acetic acid. Vesication occurs in about eight hours. At the end of that time, carefully remove the plaster to avoid rupturing the bleb and puncture the latter at its most dependent part with an antiseptic needle and dress with dry absorbent cotton. After the latter fashion the skin rapidly forms under the blister. If the latter is broken, sprinkle the surface with *orthoform*, which renders the healing painless.

Cantharides is readily absorbed from the skin and toxic symptoms (strangury, priapism and nephritis) may follow, hence blistering must be achieved with other drugs.

Methyl iodid has no unpleasant action on the urinary organs. About 15 to 30 drops of the liquid is poured on a piece of blotting paper which has been cut to the desired size and then fastened to the cleansed skin by adhesive plaster. Blisters appear in from 3 to 18 hours.

A blister may be produced in several minutes by saturat-

ing a piece of lint with chloroform and after its application covering it with oiled-silk or a watch-glass.

Equal parts of lard and ammonia will blister in about five minutes.

ELECTROTHERAPY.*

It is yet customary to regard the results obtained from electric treatment as dependent on suggestion. Mœbius tells us that four-fifths of all electric cures are dependent on mental influence. Even Beard, who, in his time, was one of the leaders in electrotherapeutics, is quoted by Kellogg as saying: "If you expect to get definite results from electrical applications, you must be sure that your patient has faith, otherwise the application will do him no good."

Electrotherapy is now founded on a scientific and, what is more important, a utilitarian basis. All currents do not show the same physiologic and therapeutic effects any more than do the various alkaloids derived from opium, although the same plant is the common source of all. The discovery of the SINUSOIDAL CURRENT is accredited to D'Arsonval, although Kellogg's description of the current in 1888, preceded the publication of the former.

The sinusoidal current does not produce the unpleasant and painful effects of the Faradic current and is decidedly more effective for the average therapeutic purpose than is the Galvanic current. The Faradic current is alternating in character in which the break in the direction of the current occurs at the maximum point of intensity. The Galvanic current is continuous and any change in the direction or in the interruption of the current is a sudden break associated with a painful shock.

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*Only the sinusoidal current will be described, as it is used by the author almost exclusively in the diagnosis and treatment of spinal diseases.

The preceding conditions with the sinusoidal current do not exist. It is probable that the rapidity of alternations is so great that the sensory nerves fail to appreciate the impressions of such high frequency. The current gradually rises from the base line, zero, to the maximum, then equally gradually returns to zero, then likewise rises to the maximum in the opposite direction, and returning to zero repeats the rhythm at the rate of many thousand alternations per minute (Fig. 42).

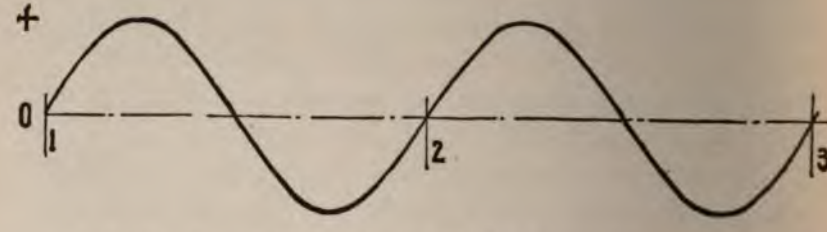


FIG. 42.—A true sine curve from which the sinusoidal current obtains its name. The length of the sine being from points 1 to 2, which is one complete cycle and two complete alternations. In what is called the 60 cycle current, which goes through this change sixty times per second, this distance from 1 to 2 represents one-sixtieth of a second and in the 125 cycle variety, 1-125 of a second. These currents are sometimes spoken of as having 7,200 and 15,000 respectively' alternations per minute, since there are, of course, two alternations (one each way) in each cycle and 60 seconds in a minute. The distance of this curve above or below the horizontal neutral line represents at each instant the potential or degree of polarity at that point, the points above the line being positive and those below negative, and this degree of polarity determines the strength of the current at that instant and the direction of its flow.

Many of the sinusoidal apparatuses on the market are such in name only and do not achieve the results cited in this work.

With the original Kenelly machine, one could obtain a frequency up to 150,000 alternations per minute. The latter machine is, however, too expensive for general use and with less costly apparatus equally efficient results can be attained.

The author's (Fig. 43) apparatus is simple in construction

and has, therefore, few of the faults of more complicated machines.

By screwing the plug attached to the cord into a lamp-socket, it is ready for use. The number of alternations is

FIG. 43.—The author's sinusoidal apparatus.

determined by a rheostat and varies from 2,000 to 20,000 per minute. It is especially constructed for the direct street-current, although it can be made available for the alternating current. With an alternating current-supply only, the value

of the current obtained is very much restricted. The Galvanic current may also be obtained from the same apparatus.

Doctor J. H. Kellogg's sinusoidal apparatus* (Fig. 44) embodies Kellogg's discoveries and is a very efficient apparatus for obtaining sinusoidal effects. It is provided with a finely graduated rheostat, by means of which the powerful

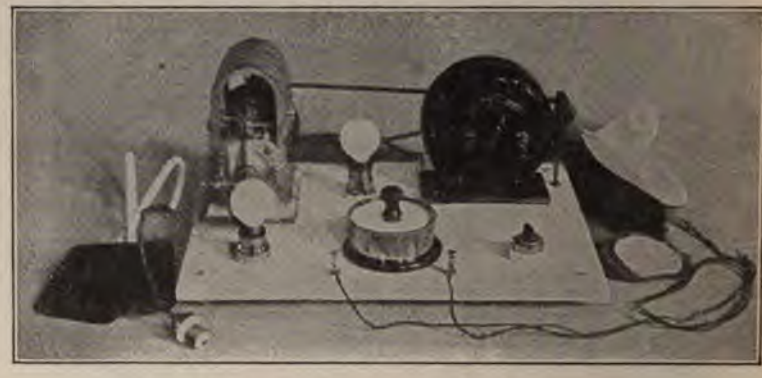


FIG. 44.—Sinusoidal apparatus of Dr. J. H. Kellogg.

currents generated may be reduced to the smallest requirement. It consists essentially of a specially constructed magneto-generator operated with an electric motor. A slowly alternating current designated as SS (slow sinusoidal), is usually employed for muscular effects, and the rapidly alternated current RS (rapid sinusoidal), is used to induce powerful tonic contractions and to secure analgesic action or other nerve-effects.

Another efficient apparatus (Fig. 45) for sinusoidal purposes is the outfit made by the Victor Electric Company of Chicago. In the multiplex outfit of the latter company one can adequately control the length of the sine wave and the voltage as well. The apparatus can be attached to any

*Made by the Modern Medicine Company, Battle Creek, Michigan.

electric-light socket and it is calculated for the direct current. It is also supplied for connection to the alternating current, but when employed in this way its value is very much restricted.

When the Victor apparatus is employed for eliciting the vertebral reflexes, the author suggests only the employment of the rapid sinusoidal current.

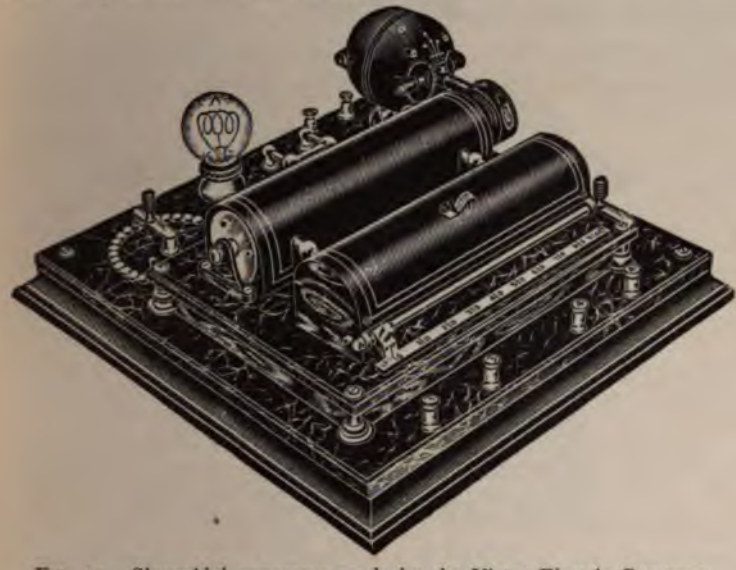


FIG. 45.—Sinusoidal apparatus made by the Victor Electric Company.

DIAGNOSTIC AND THERAPEUTIC APPLICATION OF THE SINUSOIDAL CURRENT.

This subject will be discussed in detail in special chapters devoted to visceral diseases. One of the most important properties possessed by this current by its cutaneous application alone, is the powerful and demonstrable action on the internal organs. Thus, with one electrode at an indifferent point (the author prefers the sacral region), and the other over the regions of the various organs, visceral reflexes may

be elicited. If both electrodes are applied to the abdomen it reduces intra-abdominal congestion.

By aid of this current, as will be demonstrated later, toxic intestinal and hepatic products are brought to resorption and excreted in the urine.

The various vertebral reflexes (page 7) can be elicited by this current, but for therapeutic purposes, concussion (page 175) often exceeds it in value.

The current has a specific action in hyperesthetic conditions whether superficial or deep-seated, and is of all

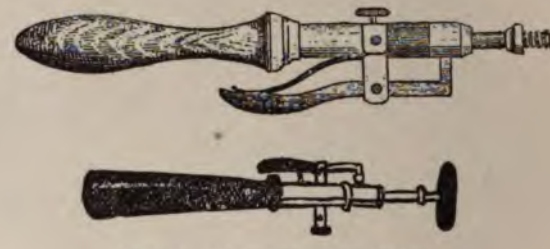


FIG. 46.—Interrupting electrodes.

currents the most available for inducing analgesic effects.

It is very often the most efficient current for developing weakened muscles and not infrequently it will provoke muscular contractions in degenerative lesions when Faradism produces no response.

In applying this current for diagnostic and even for therapeutic purposes the moistened indifferent pad (usually large) is placed over the sacrum, whereas the interrupting electrode (Fig. 46), which permits one to close and open the circuit, is placed over specific regions.

To induce muscular contractions it is not necessary, as in the use of other currents, to find the motor points (points of greatest excitability). To obtain the maximum contraction of the muscles of the back, the latter must be relaxed.

To excite the *muscles of the back* for diagnostic or developmental purposes strong currents must be used. Referring to Fig. 47, the effects of a strong sinusoidal current are noted

FIG. 47.—Muscles of the back showing Triangle of Petit (shaded triangular area). The *trapezius* retracts the scapula and braces back the shoulder; when the head is fixed, the upper part of the muscle will elevate the point of the shoulder (electromotor point, E.M.P., A), whereas the lower fibres depress the scapula (E.M.P., B); with fixed shoulders, action of one trapezius will draw the head to the corresponding side (E.M.P., C). The *latissimus dorsi* when the arms are fixed raise the lower ribs and assist in forcible inspiration (E.M.P., D). Application of the electrode at any of the points marked E, E, E, will accentuate the lordosis in the lumbar region and, at F, on the right side, scoliosis is produced to the left side, and, at a corresponding point on the left side, scoliosis to the right side. By marking the tips of the spinous processes or by noting the spinal furrow, the scoliotic changes are best observed. G, electromotor point which causes an approximation of the scapula to the spine.

when one pole is applied over the sacrum and the interrupting electrode is placed at various points indicated by circles. The effects of this current can be more easily demonstrated

if the spinous processes are marked with a pencil, thus indicating any deviation of the vertebral column. Changes in the curvature of the spine are naturally less evident in adults than in children.

This current is specially indicated when the development and strengthening of the spinal muscles are the objects in view. Here the electrodes must be placed at corresponding points on either side of the spine so that the muscles on one side should not exceed in development or strength the muscles on the other side. By inducing the central reflexes (page 11), a symmetrical development is easily achieved.

A *backache* is very frequently a weak back; the muscular tire graduating into pain and here the remedy is muscular development.

It is difficult to devise any exercises which will bring into action the thirty-one muscles of the back which are subdivided into five layers.

Not infrequently, the so-called *uric-acid* diathesis is a localized intoxication; the unused muscles favoring the precipitation of uric-acid or other products of defective metabolism and creating what is popularly called "stiff-back." To destroy such products, it is necessary to bring a greater supply of blood to the parts, for more circulating blood means more oxygen and more oxygen means better nutrition. Sinusoidalization of the muscles of the back is more efficient than any exercises. The author has investigated the output of urea before and after sinusoidalization of the muscles of the back in many cases of backache and noted the pertinent fact that, as a rule, there was an augmented excretion of urea after sinusoidalization. Voit has shown that work does not increase the elimination of nitrogen by the urine, hence the increased output in my cases was due to the removal of urea stored up in the muscles.

It is evident to the reader that in the event ***muscular rigidity*** is present, muscular contraction is less readily elicited by the current than when the muscles are relaxed, hence in this respect, the current subserves a diagnostic use.

EXERCISES.

About one-half of the body-weight is dependent on the muscular system which, even in a state of rest, holds about one-quarter of the total quantity of blood When the muscles are in activity the amount of blood which they hold is very much augmented.

Muscular exercises subserve the following objects:

1. They increase the frequency and amplitude of the respiratory movements.
2. By increasing pulmonary capacity they aid the work of the right heart.
3. By determining an increased quantity of blood to the muscles* certain congested areas are depleted.†
4. Waste-products are increased in the blood and there is augmented excretory activity of the kidneys, skin and lungs.

In prescribing exercises, one must never forget their baneful effects on the nervous system when carried to excess.

When a muscle is fatigued by voluntary contraction, it involves not only the muscle but the nervous system, and the latter to a larger degree than the former. It is erroneous to suppose that a healthy nervous system can be acquired by vigorous muscular exercises. The latter always means an expenditure of nerve-force which may, or may not, be beyond

*Oliver has shown that the relative quantity of the corpuscles is increased in the blood of an exercised limb.

†The same author has demonstrated that while, after a period of rest, a relatively large amount of blood can be expressed from the abdomen into the systemic vessels, no such result can be attained by abdominal compression after exercises.

the capacity of the individual. Many nervous wrecks are recruited from this fallacious argument.

Spinal exercises achieve the following objects:

1. Increased flexibility of the spine.
2. Strengthening the muscles which hold the trunk erect.
3. Combating a faulty attitude.

Supports and plaster-jackets in the treatment of curvatures are only indicated in acute inflammatory affections of the bone. Otherwise they conduce to ankylosis in a deformed position with muscular atrophy from disuse.

Impaired mobility of the spine is frequently the cause of distressing backaches, sciaticas and other affections. Here passive movements of the spine are often curative. The patient sits on the bed and the physician can repeatedly force the body forward or he can execute any degree of traction on the arms.

Exercises for the muscles of the back are most often prescribed in the treatment of *round shoulders* and *lateral curvature.*

ROUND SHOULDERS.*

This condition is more frequently encountered in girls than in boys, owing to the fact that in the adjustment of clothes there is a drag upon the shoulders equal to several pounds on either side. Here, as Goldthwait suggests, the weight must be removed from the outer part to the inner or rigid part of the shoulder at the base of the neck. The patient should be taught to assume a correct position, chest-deformities must be corrected by breathing, gymnastics, and the following exercises recommended by Lovett are indicated:

*Vide page 96.

1. The patient hangs from a bar by the arms.
2. In the recumbent position, with a hard roll under the scapulæ, the arms are extended and stretched and pulled above the head upwards and backwards by an assistant.
3. The patient sits on a stool with the hands behind the head and the elbows squared; during the time the elbows are pulled backwards, the knee of the manipulator presses forward against the spine on a level with the shoulders.

LATERAL CURVATURE.

Here muscular exercises constitute the essential part of the treatment. At least one hour daily must be devoted to their execution, and as Robert Jones suggests, the arms should always be moved by direct muscular effort and not allowed to swing.

Ridlon[49] employs the following exercises:

1. The patient lies upon her back upon a table of convenient height, width and length. The Swedish table known as the plinth is perhaps the most convenient. With her arms at the sides of her body, and the palms upwards, she breathes slowly and deeply ten times. In patients who present a projection of the ribs below the breast, it is of advantage for the surgeon to make pressure downwards with his hands upon these projecting ribs as the patient takes a full breath.
2. The patient grasps a bar of steel shafting 3–4 ft. in length and 10–20 lbs. in weight. With the elbows straight, she swings this from the thighs forwards and upwards above the head until the bar reaches the level of the table. From here she swings it downwards again to the thighs, and this is repeated ten times.

3. The arms are then stretched directly outwards from the sides of the body, and in this position, as in (1), she breathes deeply ten times while the projecting ribs are held down by the surgeon.

4. Again, the iron bar is swung from the thighs to the table above the head and back ten times.

5. Then the arms are stretched upwards by the side of the head to the fullest reach, care being taken that the lower shoulder is raised as far as the other. The arms are held in this position, and the patient breathes deeply ten times, the ribs again being held down.

6. Then an iron bar of the same length, but double the weight of the former, is placed in the patient's hands as she lies upon her back, and she raises it directly upwards from the chest, fully straightening the arms, and repeats the exercise ten times.

7. Still lying on the back, with the knee held straight and rigid and the foot extended, the patient circles the limb from the hip-joint, making as large a circle as possible with the foot ten times. Then the other limb is circled in the opposite direction ten times.

8. Still lying on her back with hands grasping the top of the table, both limbs are lifted, while the knees are held straight and the feet extended upwards to the fullest point, if possible to the vertical position, and repeated five times.

9. The patient then turns on her face, is pushed out so that the body extends beyond the end of the table by the surgeon, and she, holding the head and shoulders as high as possible, makes with her arms the motion of swimming, the forward stroke of which should be particularly vigorous. In this position ten strokes are taken.

10. The patient is then pulled back upon the table, and lying face downward with the knee straight and the foot extended, she circles first one leg and then the other, making the largest possible circle with the foot, ten times.

11. The patient is again pushed out with the body beyond the end of the table, and with the arms in the key-note position, she bends the body downwards and raises it upwards as far as possible. This is repeated five times.

The key-note position consists of such a position of the arms as places the back in the straightest line. For an ordinary dorsal curvature with a convexity to the right, the key-note position consists of pushing the left arm as far as possible up beside the head and holding it there close to the ear, while the right arm is stretched directly outwards with the palm turned upwards; but the key-note position must be determined for each particular case.

12. With the patient again pulled back and lying comfortably upon the table, she takes a 5-lb. dumbbell in each hand, and swings them outwards and upwards, that is, backwards, as far as possible, ten times.

13. The patient, still lying on her face on the table, places her arm in the key-note position; then as she counts aloud one, two, the legs are held down, she raises the head and shoulders upwards and backwards as far as possible; then, counting three, four, she bends the head and shoulders as far as possible towards the convexity of the curvature; then counting five, six, she twists the head and shoulders around towards the side of the convexity, as if in an effort to look over the shoulder; then, counting seven, eight, she swings and turns back into the straight position from which she started, and this exercise is repeated five times.

14. The patient then sits astride the narrow end of the table, while the surgeon sits astride the table behind her, steadying her hips with his knees. Then, with arms in the key-note position and the spine as straight as possible, she bends forward from the hips freely, and then backwards against the resistance exerted by the hands of the surgeon. This is repeated five times.

15. Then, with the arms stretched out from the side, she twists the body freely towards the side of the concavity; then she twists backwards towards the side of the convexity against the resistance afforded by the hands of the surgeon, one hand resting against the ribs forming the convexity of the curvature at the back and the other against the ribs that are prominent below the breast in front. This exercise is repeated five times.

16. The patient is then bent backwards and to the side of the convexity of the curvature over the knee of the surgeon, so that her waist rests through the bulging ribs across his knee, while the shoulder on that side is twisted still further backward. In other words, the position assumed is the one, both as to flexion and rotation, which most nearly corrects or over-corrects the spinal deformity. Lying lax in this position, the patient breathes deeply ten times.

In the early months of treatment greater improvement will be gained if the patient exercises in the prone position. Patients with lateral curvature are able to lie with the spine straighter than when they sit or stand, and the success of the treatment depends greatly upon making muscular effort while the spine is at its best.

Klapp's "*Creeping Exercises*" are not only useful in scoliosis but are equally efficient in expanding the chest by mobilizing the thoracic vertebræ.

The patient kneels, the thighs perpendicular, the elbows bent so that the arms imitate the bow-leg position of the dachshund while the head is bent far back. The pelvis is thus above the shoulders and the thoracic portion of the spine is in lordosis; this position must be maintained during the creeping. The arm is advanced and stretched before the hand touches the floor. This hand then turns and the elbow is bent as the trunk is advanced until the upper arm forms a right angle with the trunk. The arm thus forms the axis over which the thoracic vertebræ are levered by the drawing forward of the other arm, the scapula of the supporting arm forming the fulcrum of the lever. This exercise loosens up the thoracic vertebræ and spreads the ribs apart, and corrects torsion of the spine if present. The thorax expands more, the more correctly the lordosis of the thoracic vertebræ is localized during the sideward bend.

RE-EDUCATION OF CO-ORDINATED MOVEMENTS.

In *locomotor ataxia*, co-ordination exercises are of great value in regaining control of the voluntary movements which have been lost. The exercises in question exert no effect on the lesions and the best results are attained when the motor tract is intact. It is not necessary to employ the apparatus of Frænkel to achieve results; in fact, good results are equally achieved without apparatus.[41]

In executing the exercises the following rules must be observed:

1. One must begin with simple exercises; first with the eyes open and later with the eyes closed. Each movement must be executed with precision.
2. Fatigue must be avoided, hence the exercises should be taken in the recumbent and later in the sitting and erect postures. Fatigue may be avoided by

counting the pulse which, when increased in frequency beyond the norm, indicates that the exercises must be temporarily suspended. At first the séances should not last longer than about ten minutes and later the entire exercises, including resting periods (to enable the pulse to become normal) should not exceed thirty minutes.

3. A trained assistant for supervising the exercises is equally as important as the patient's perseverance.

Respecting the nature of the exercises, each physician will suggest his own methods. After the patient succeeds in executing simple movements with his ataxic extremities, then walking exercises like the following are indicated:

1. Line-walking in a straight line.
2. Walking at a mark which is placed on a wall at a limited distance.
3. Obstacle-walking. By placing books on their long edges about 20 inches apart and then directing the patient to walk over them.
4. Stair-walking. Ascending and descending steps.

SPINAL-HYDROTHERAPY.

The spinal-coil has replaced the Chapman bags. The former consists of thin rubber tubes through which a continuous current of water of any desired temperature is permitted to flow and is applied to the spine (never directly upon the skin) upon a thin moist compress. The bags of Chapman consist of the usual rubber bags (long and narrow) which can be filled with ice or water of any desired temperature and are placed upon the vertebral column. Cold applied to the cervical spinal-region (used in asthma and cardiac irritability) has a primary stimulating action succeeded by sedation. Cold applied to the lumbar spine,

determines an increased flow of blood toward the lower extremities and the pelvic organs. Heat applied to the lumbar spine is said to diminish the flow of blood to the pelvic organs hence it is indicated in excessive menstruation. Cold applied to the entire spinal column reduces general reflex irritability and is employed in spinal neurasthenia.

In the rational employment of hydrotherapy, heat or cold water must be applied by means of a douche to definite vertebræ to elicit specific reflexes. The author, however, regards electricity and vibra-massage as more convenient methods insomuch as the object to be attained irrespective of the method employed is to evoke definite reflexes. Winternitz suggests the use of cold water poured over the back of the neck for relieving nasal congestion. He ascribes the result to action on the vaso-motor center. Elsewhere (page 284), the author directs attention to a more certain and permanent method for achieving the same object.

LUMBAR PUNCTURE.

Lumbar puncture is usually made just below the tip of the fourth lumbar spine (fourth interlaminal space) with a sterilized needle about three inches in length attached to a syringe or with a small trocar and canula.

If a horizontal line is drawn across the back on a level with the highest points of the iliac crests it will cross the spine at the level of the tip of the 4th lumbar spine.

The patient should lie on the left side with knees drawn up and the trunk bent forward. The skin at the site of the puncture may be frozen. The physician places his finger on the tip of the 4th lumbar spine and introduces the needle half an inch below and to the right of the 4th lumbar spine, and directs it horizontally forwards and a little inwards until the arachnoidal space is reached. When the syringe is

detached, the fluid escapes in drops and the amount permitted to escape at a single séance should not, as a rule, exceed 5 cc.

Lumbar puncture is indicated for the relief of headaches of various origin due to augmented intracranial pressure. Thus, the pains secondary to herpes zoster have been relieved by the withdrawal of 20 cc. of fluid and it was therefore assumed that hypertension of the fluid existed.

Vertigo and tinnitus dependent on increased pressure of fluid in the internal ear are likewise relieved.

MASSAGE.

The pressure exerted by massage influences all the tissues within its reach. It increases the power of endurance and abolishes fatigue. Experiments on frogs show that, after the muscles have been exhausted, their loss of vigor is soon restored by massage, whereas rest without massage has no effect.

Massage increases the flow of blood and lymph. Brunton has shown that the blood passes three times more rapidly through a part while it is being masséed than when it is not. In many cases there is an increase in the number of red corpuscles and in the hemoglobin. Upon the nervous system, massage, if properly done, has a sedative effect.

Therapeutically, massage accomplishes the following:

1. It assists the peripheral circulation and lessens the work of the heart.
2. In tissues accessible to manipulation it hastens the resorption of exudations and separates adhesions in joints and tendon-sheaths.
3. It augments the oxidizing powers of the blood, thus modifying disturbances in its composition.

4. By stimulating the sympathetic nervous system it promotes secretions and various reflexes, and thus gives relief in functional derangements.

5. By augmenting the flow of blood in the muscles it diminishes congestion of the viscera.

6. Wright has demonstrated that the effect of massage on an infected joint, by discharging a number of bacteria into the circulating blood, is to raise the opsonic index, after temporarily lowering it in in the first place.

In the manipulation of joints any elevation of temperature signifies extreme caution in manipulation, in fact, any increased temperature is a contra-indication for the employment of massage in affections of the joint. When it is a question between a functional and an organic joint-lesion the experience of the author shows that if fever follows passive movements of the joint it suggests an infectious lesion and the leucocyte count, as a rule, is increased.

Dowse observes that ten minutes massage of the spine will increase the volume of the pulse and the temperature generally more than one hour's work at the body as a whole, the spine being omitted.

Fig. 48 demonstrates a series of visceral reflexes excited by deep pressure at the vertebral exits of the various spinal nerves. The foregoing figure has been elaborated after a series of very careful clinical observations by the author. Firm pressure is usually made with the thumb of one hand and it is indeed remarkable how, in many instances, the symptoms may be relieved and even cured by such deep and firm pressure over definite regions. It is evident to the reader that if such pressure is executed promiscuously, counter-reflexes are evoked which nullify the reflexes sought. In fact, the symptoms by such promiscuous manipulation may

be accentuated. One may observe quite frequently that when pain due to a spinal neuralgia is associated with a point of vertebral tenderness, temporary inhibition of the pain may be achieved by deep pressure on the sensitive vertebral area and, in this respect, pressure may accomplish in an emergency almost as much as psychrotherapy. If the pains are of visceral origin and are associated with a point of vertebral tenderness, pressure upon the latter point is decidedly less

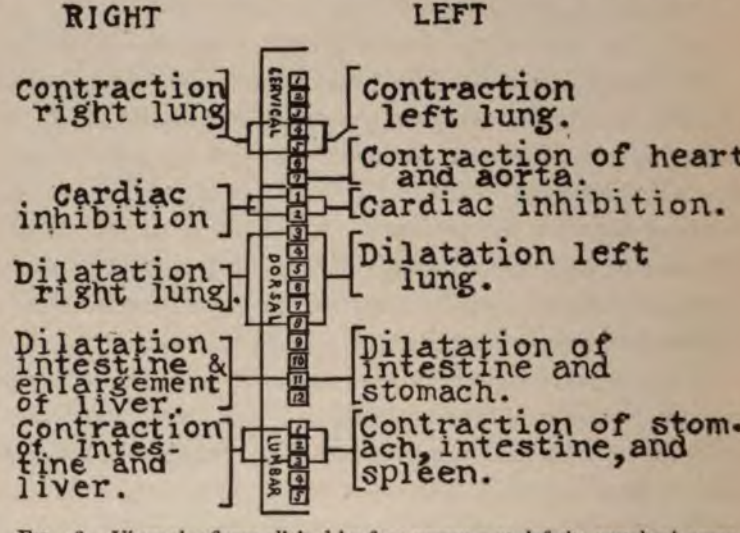


FIG. 48.—Visceral reflexes elicited by firm pressure at definite vertebral areas.

effective in relieving the pains. When it is necessary to make more forcible compression at the vertebral exits of the sensitive nerves the author employs his vibro-suppressor (Fig. 32) with a smaller pelote or he makes pressure with one end of the rubber of a pleximeter. The latter is shown in Fig. 2.

Assuming that a patient has a neuralgia of the cervico-occipital nerves, one seeks for a sensitive point at the vertebral exits of the cervical nerves usually on one side of the spine. As a rule, muscular spasm of the cervical muscles

is associated with such a vertebral area of tenderness. Hence, before pressure is exerted by the thumb over the area of sensitiveness, the head is thrown backwards so as to relax the muscles. As a rule, pressure is primarily painful, but it soon yields to continued pressure and the neuralgic pains cease at once. A repetition of such manipulation may be necessary on successive days before the pain is permanently relieved.

The author has observed that pressure exerted after the foregoing method at the vertebral exit of a spinal nerve has usually only a slight effect on the cutaneous sensitiveness in the normal subject. If, however, the nerve is the site of a neuralgia, a decided effect can be observed on a given area of skin-tenderness.

Many osteopaths exercise great discretion in their manipulations insomuch as they do not massage the parts affected, but exert pressure upon the exits of the spinal nerves which are correlated to the parts involved. Thus the parts implicated are merely placed at rest and not manipulated until the acute symptoms have subsided.

The POINT OF ELECTION for pressure at the vertebral exits of the spinal nerves may be determined (if spasm or tenderness is absent) by noting the site of spasm of the spinal musculature (page 47), when an organ or tissue peripheral to the region of the spine is manipulated or by the development of an area of vertebral tenderness* (page 71) after such manipulation.

The *conductivity of a nerve* may be temporarily diminished

*The area of vertebral tenderness is often more conspicuous on the side of the spinal column *opposite* to the source of cutaneous irritation and this fact must be taken into consideration in employing our therapeutic manœuvers. The foregoing observation aids in solving the dubitable question concerning the propagation through the spinal cord of sensory impressions received by the skin; in all probability, the impressions after entering by the posterior horn ascend on the same side, whereas other impressions cross to the opposite side.

or abolished by external pressure (familiar example of the limbs "going to sleep") without annihilating its physical integrity.

As remarked on a previous page (page 72), some writers associate the areas of paravertebral tenderness with the vaso-motor subcenters in the cord and claim that when the areas have become chronic, the paravertebral tissues are infiltrated and thickened. Here deep massage of the affected areas is indicated.

PSYCHROTHERAPY.

In the treatment of localized areas of vertebral tenderness, nothing in the experience of the author exceeds cold as a remedial measure. To attain any result, however, the skin overlying the area of tenderness must be distinctly whitened and frozen and this condition must be maintained for one or two minutes. Very often a single application suffices for the cure of a neuralgic affection but, in other instances, the process must be repeated on several successive days.

The author has never noted any bad effects from such radical freezing as a remedial measure. The hyperemia resulting may be assuaged by a simple dressing of zinc ointment on lint fixed to the part with adhesive plaster. Among the agents used for freezing are *rhigolene* and *ether* which are used in an atomizer and directed on the part to be frozen.

Recently the author has been unable to obtain rhigolene, hence ether was employed in its place. Other freezing agents are *ethyl chlorid Bengué* and *Kélène*, which are sold in glass tubes and by holding one of the latter in the hand a fine jet is projected on the area to be frozen. The nozzle is held from 6 to 8 inches from the skin. The latter first becomes pink, then a deep red and finally white, like parchment. The latter degree must be reached and maintained for several minutes.

The author has also used for freezing a preparation of ***benzine*** (Distilled between 35 and 45 degrees C.), which is a cheap and efficient fluid for freezing. The odor of the latter, like ether, may be objectionable, but this may be corrected by the addition of some essential oil to either preparation.

Many preparations of ether on the market are quite inefficient, but if ethyl chlorid is first used until the skin is whitened, almost any preparation of ether will maintain the freezing *ad libitum*. Ethyl chlorid or Kéléne is too expensive if used extensively, hence, in the absence of a reliable ether preparation for freezing, first freeze with ethyl chlorid or Kéléne and then maintain freezing with practically any preparation of ether.

The foregoing liquids are inflammable and should not be used near a light.

In an emergency, a piece of ice sprinkled with fine salt and held against the skin by means of a towel will freeze the part.

The author has had no personal experience with either liquid air or carbonic acid snow for freezing purposes and for information on this subject the reader is referred elsewhere.[41]

In intractable pains due to lesions at the vertebral exits of the nerves, the author has had recourse to what he calls *reinforced freezing*. It consists of injecting sterilized water beneath the skin over the part to be frozen or directly into the tissue until an appreciable bulging is produced. If the freezing solution is now directed on the protuberant part, a lump of ice is formed under the skin or in the tissues. Respecting the rationale of congelation the author directs the reader elsewhere[42] to his investigations on the subject. *Vide* page 187, concerning the use of freezing in spinal neuralgias.*

*Vide page 367, concerning the employment of concussion for the relief of pain.

THERMOTHERAPY.

This refers to heat as a therapeutic agent. Media having a temperature above that of the body are referred to as hot

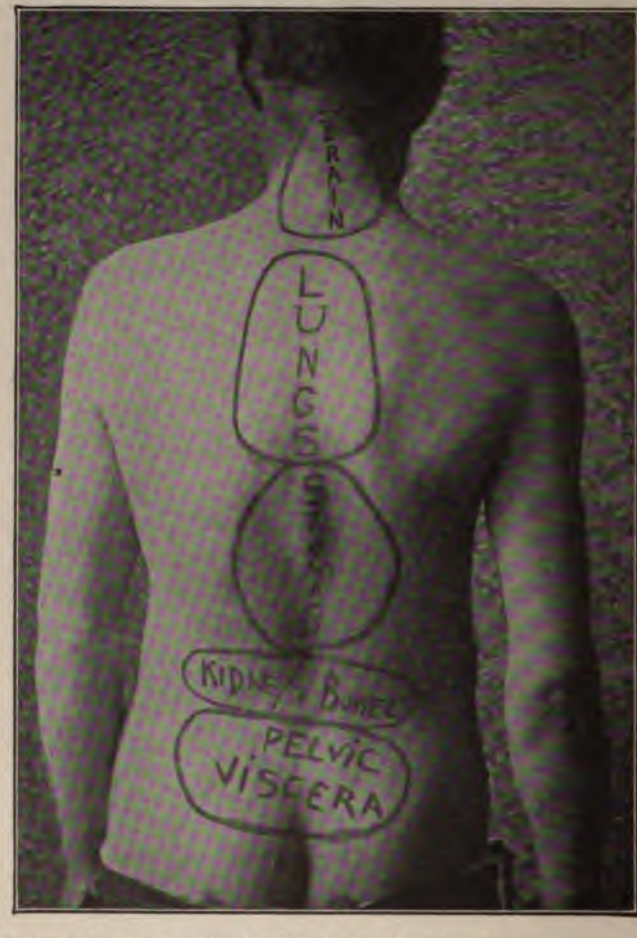


FIG. 49.—Cutaneous areas for influencing the viscera.

and as very hot, when the temperature exceeds 104 degrees F. (40 degrees C.).

Respecting the physiologic effects of heat, it suffices to say, that a prolonged application of a high temperature is primarily an excitant, and secondarily, a depressant; a brief application, however, is strongly excitant and the depressing effects, if any, are imperceptible.

The viscera are influenced reflexly through cutaneous areas (Fig. 49) which have been definitely established and are of great clinical importance. As a rule, the cutaneous reflex areas overlie the individual viscera, but in the author's experience, the most pronounced effects are achieved by the application of heat (very hot water in small rubber bags) over the different vertebral regions; a brief application to secure stimulating effects and a prolonged application to achieve sedative action.

Von Bernd, by means of an apparatus which consists of a transformer, a high frequency current is obtained from the usual electric supply and which, when passed through the tissues, subjects the latter to any degree of heat which can be modified at will. With this apparatus the gonococci in an infected joint have been killed within one-half hour.

ELECTRO-THERMAL PADS of any size, attachable to an electric light socket, are now purchasable and supply a uniform source of heat. They are also made to contain material used for cataplasms, thus obviating the necessity of changing the latter to secure a constant supply of warmth.*

VIBRATORY MASSAGE (SISMOTHERAPY).

Vibra-massage or mechanic vibration has achieved some distinction as a remedial measure, but owing to its indiscriminate application without regard to physiologic principles, most of the results attained by its use must be attributed to

*Made by the F. R. Whittlesey Co., 591 66th Street, Oakland, Cal.

suggestion. The author only seeks to discuss vibra-massage with reference to its spinal application, and it will be evident to the reader if he has given careful consideration to the vertebral reflexes (page 7), that the manipulation of definite vertebræ corresponds with the elicitation of definite reflexes but, if the vertebræ are promiscuously handled, counter-reflexes are evoked, which may often accentuate the reflexes in action and thus intensify the co-existing symptoms.

The foregoing sentence has been quoted several times throughout this book, but it is deserving of repetition.

In the therapeutic elicitation of the vertebral reflexes, the only kind of vibratory apparatus which is effective is one giving the PERCUSSION STROKE. All other motions, such as oscillations, shaking and friction, interfere with the results. In other words, it is *concussion* and not vibration which is effective.

Vibration is milder and of higher frequency than percussion.

The author has tested very many devices for vibra-massage and has been disappointed with the results. Thus there are many instruments which concuss, but in so doing, they also produce considerable friction, which is undesirable in prolonged séances with the apparatus.

When the author first employed vibra-massage with inadequate apparatus, the friction provoked in association with concussion, resulted in severe wounds over the spinous processes. Such accidents no longer occur in the author's experience, although the spinous processes may become tender owing to a mechanic periostitis which is of little or no consequence.

With an apparatus which does not cause friction, the concussors (Fig. 50) may be applied directly to the spinous process or processes and the application can be prolonged

for several minutes at a time. In the event friction attends the use of the apparatus, one must interpose some medium between the concussor and the spinous process. Here a strip of linoleum is efficient and the treatment must be interrupted at once if the patient complains of a burning sensation.* The author's apparatus (Fig. 50) is essentially a

FIG. 50.—The author's pneumatic hammer with concussors.

pneumatic hammer giving a stroke of 1¼ inches and operated by compressed air. The force of the concussion-blow may be regulated by a stop-cock or by the pressure of the concussor on the spinous process. To start the action of the hammer it is often necessary to place the finger on the suction opening and then suddenly release it or strike the concussor forcibly with the hand. The absence of latch pins, springs or plugs avoids any waste of air and insures a steady working

*If a layer of rubber (1 cm. in thickness) covers the surface of the concussor, no heat is generated and there is no necessity for interposing a medium between the skin and the concussor.

hammer. No vibration is transmitted to the operator's hand. Although quite heavy, it is easily manipulated, being suspended from the ceiling by means of a counter-weight. The concussors are of different sizes to include one, two, three or more spinous processes. The apparatus in question is only available when compressed air of considerable pressure can be obtained, but this is rarely objectionable insomuch as all modern office buildings are equipped with air compressors.

Smaller pneumatic hammers are procurable, but they can only be regarded as mere toys for the elicitation of the vertebral reflexes.

An efficient percussion-stroke may be obtained from an electric apparatus (Fig. 51). It strikes from 3,500 to 5,000 blows per minute, and the force of the blow varies according to the pressure on the spine by the concussor in the vibrator from an imperceptible to the maximum blow. It is run with a ⅛ H. P. and may be arranged for any kind of an electric current. The only objectionable feature is its price (about $160).

If the physician cannot obtain an efficient apparatus, then a hammer and pleximeter (Fig. 2) may be used with fairly good results. In the excellent book[44] of Doctor M. L. H. Arnold Snow, the author specially cautions the reader to avoid the spinous processes in the application of vibration. In my opinion, this caution is absolutely unnecessary. Many times a day, for years, the author has concussed the spinous processes most unmercifully, yet he has never noted any untoward results. His experience in this regard, prompts him to side with those who hold that spinal concussion and cerebral commotion cannot give rise to the symptoms of a traumatic neurosis, for otherwise, many of his patients would have been the victims of "railway spine," insomuch as they have been subjected to as much concussion as they would

FIG. 51.—Electric concussion-hammer.

have experienced in several railroad accidents without suffering from any untoward results.*

It will be noted in the special chapters that vibra-massage is, in some instances, more efficient than the sinusoidal current for the elicitation of the vertebral reflexes. It may also be noted, that if treatment with either method is too prolonged, the spinal visceral reflexes become exhausted and a condition other than that sought for will result. Experience only will determine the time necessary for each treatment, although the relief of symptoms is a fair gauge for the duration of a séance.

Reference has been made on page 169 to the increase of temperature following massage of the spine, but in the opinion of the author, concussion with the pneumatic hammer is decidedly more efficient. Concussion of any of the spinous processes will elevate the temperature, but the best results are achieved when the spinous process of the 7th cervical vertebra is concussed. The two following cases of *myocarditis* are cited to show the effects of concussion on the spinous process of the 7th cervical vertebra:

CASE I.

Temperature before concussion.....97.2° F.
" after " for 4 minutes ..98° F.
" " " " 8 " ..98.8° F.

CASE II.

Temperature before concussion.....96.4° F.
" after " for 4 minutes...98° F.

No such effects could be produced with the sinusoidal current.

*The fear of employing forcible concussion on the spinous processes and the use of inefficient apparatus are responsible for the inefficient results achieved by vibra-massage.

The author does not believe that elevation of temperature following concussion of the 7th cervical vertebra is dependent on stimulation of a problematic thermogenic center, but to a stimulation of the heart (heart reflex).

In *fever*, the author has never succeeded in reducing the temperature by aid of concussion of any of the spinous processes, although his efforts have been many. The employment of concussion to induce analgesia is discussed on page 367.

CHAPTER VI.

PSEUDO-VISCERAL DISEASES.

NEURALGIA—INTERCOSTAL NEURALGIA—DIFFERENTIAL DIAGNOSIS—PSEUDO-APPENDICITIS—PSEUDO-CEREBRAL DISEASE—PSEUDO-ANGINA PECTORIS—PSEUDO-ARRHYTHMIA — PSEUDO-ESOPHAGISMUS —PSEUDO-NEPHROLITHIASIS — PSEUDO-DYSPEPSIA — PSEUDO-CHOLELITHIASIS—PSEUDO-MAMMARY NEOPLASMS.

EVERY physician owes a modicum of his success to the recognition and successful treatment of some special disease. In this respect, the author's talismanic affection is neuralgia of the spinal nerves with their bizarre and protean manifestations. The author may be pardoned for his apparent presumption when he asseverates that he feels justified in having written this book, if for no other reason than to direct the attention of the profession to recognize the greatest simulator of visceral diseases, viz., NEURALGIA OF THE SPINAL NERVES.

It very frequently happens that neuralgia of the spinal nerves may be accompanied by visceral symptoms of such prominence that the neuralgia is overlooked and unsuccessful treatment is directed toward the supposititious visceral disease. Such cases, while presenting varied clinical pictures, are frequently analogous, if only atypically so, to gastric, cardiac, renal, vesical and intestinal affections. The neuralgic paroxysms occurring in spinal diseases like tabes are manifested by symptoms occurring in organs like the stomach, intestine, bladder, etc. Here, like in neuralgias of the spinal nerves, we are dealing with lesions represented by nerve-root symptoms. Many pseudo-visceral diseases may be partially explained by the anastomosis existing between

the spinal and sympathetic nerves (*vide* sympathetic sensations, page 57). *Neuralgia of the intercostal nerves* most frequently simulates visceral disease.

The upper group of the thoracic nerves is distributed entirely to the thoracic wall and the lower group (7th to 11th) is distributed partly to the thoracic and partly to the abdominal wall. It is the latter fact which often makes the recog-

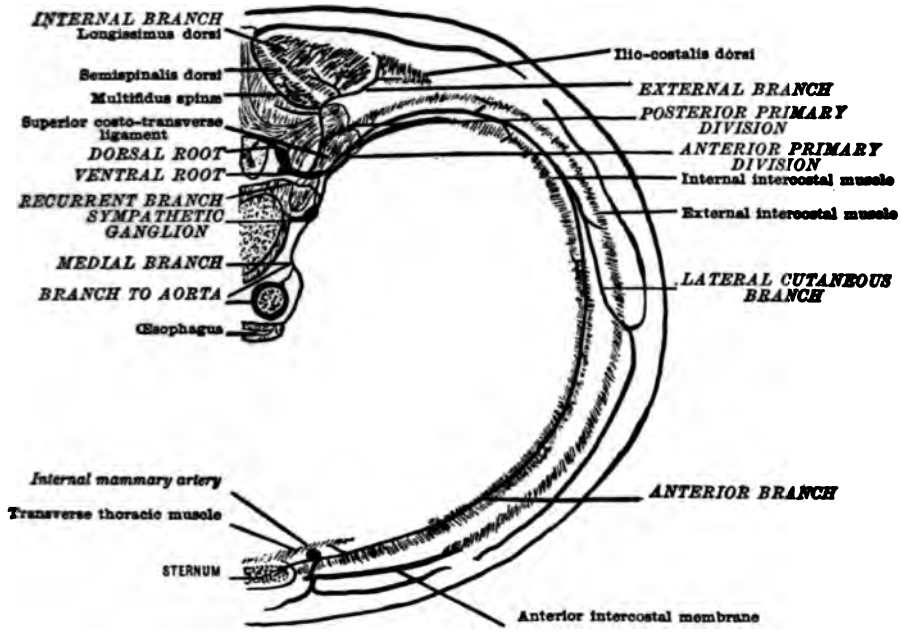


FIG. 52.—Diagram of the distribution of a typical thoracic nerve (Morris).

nition of intercostal neuralgia difficult, insomuch as the word intercostal (between the ribs), connotes an erroneous topography in the localization of pain. It is evident that in diseases affecting the nerve-trunks at or near their origin, the pain is referred to their peripheral terminations. Thus, in Pott's disease of the spine, the pain is referred to the belly, owing to the irritation of the nerve-trunks at their origin. In

pneumonia or in pleural affections, the pain may be referred to the abdomen or the right iliac fossa and may suggest appendicitis. Here the lower thoraco-abdominal nerves are irritated owing to their juxtaposition to the pleura.

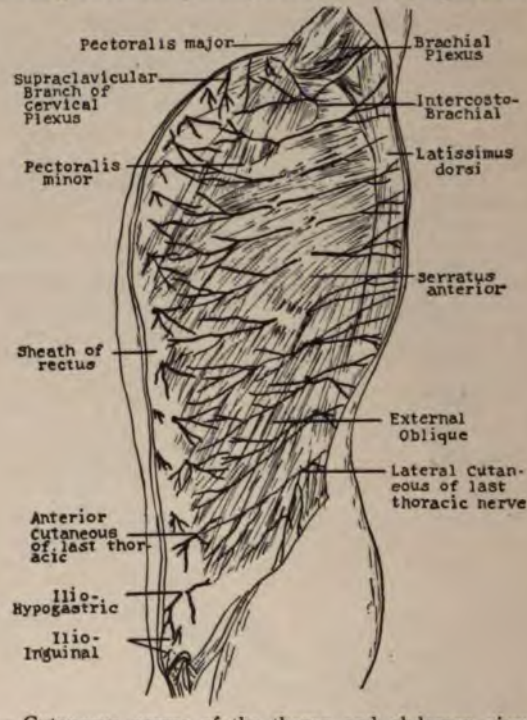


FIG. 53.—Cutaneous nerves of the thorax and abdomen viewed from the side (Morris, after Henle).

A typical thoracic nerve is shown in Fig. 52. In the posterior parts of the intercostal spaces, muscular branches are distributed to the levatores costarum and the nerves pass forward between the external and internal intercostals and divide into: 1. Lateral branches, which after penetrating the external intercostals near the mid-axilliary line, divide into anterior and posterior branches. 2. Anterior branches, which at a short distance from the sternum give off terminal

branches. Fig. 53 shows the cutaneous nerves of the thorax and abdomen.

To properly appreciate this subject it will be necessary first to describe neuralgias in general and later intercostal neuralgia in particular.

NEURALGIA.

Neuralgia is usually a unilateral affection associated with paroxysmal pains and painful areas (*points douloureux*) on pressure at certain points in the course of the nerve where the latter passes through bones, muscles, or lies superficially. The painful areas are also present in the interparoxysmal periods.

Associated symptoms of neuralgia are: disturbances of sensation (hyperesthesia or anesthesia), vaso-motor symptoms, anemia or hyperemia of the skin and increase of the secretions, trophic disturbances and localized clonic spasm of the muscles.

The pains in neuralgia are usually localized to a single nerve, but at the height of the paroxysm the pains may radiate to other nerves.

MUSCULAR PAINS show diffused areas of tenderness in the muscles, are dependent on movement and are not paroxysmal.

Malaria has often been accused as an etiological factor in neuralgia because the pains are paroxysmal, but this is an erroneous supposition insomuch as the pains of neuralgia, irrespective of cause, are paroxysmal.

Again, syphilis is accepted as a cause because the paroxysmal onset occurs at night. But this feature is common to many neuralgias. On the other hand, the absence of nocturnal exacerbations speaks against syphilis.

Among the more frequent etiologic factors of neuralgia are:

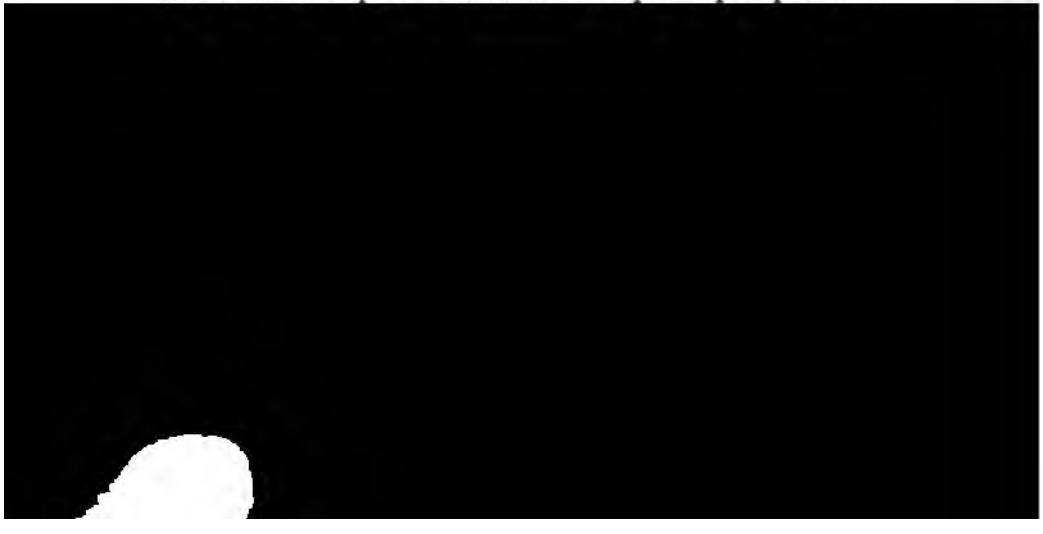
1. Mechanic (pressure on nerve from growths, exudations, etc).
2. Thermic (chilling draughts, etc).
3. Toxic (drugs, infectious diseases and nutritive disturbances).

One must not forget that, whereas in the majority of instances intercostal neuralgia is primarily due to cold (with the lesion at the vertebral exit of the nerve), it may be secondary to vertebral disease, spinal meningitis and pressure from an aneurysm, tumor, etc.*

INTERCOSTAL NEURALGIA.

As before remarked, the diagnosis of this affection is not difficult when the middle intercostal nerves are involved; the difficulty arises when the lower group is involved, owing to the distribution of the nerves to the skin of the lateral and anterior abdominal wall.

In intercostal neuralgia three painful points are invariably found on pressure, viz., at the vertebral exit of the nerve, in the mid-axillary line and in the median line of the thoracic and abdominal walls. The point at the vertebral exit is most constant and the method for the elicitation of the pain or tenderness has already been described on page 66. Here a word of caution is necessary. Unless the muscles are relaxed the contracted muscular fibers over the areas of tenderness will prevent elicitation of pain upon pressure.



the point first from above and, when the sensitive area is reached, it is marked with a dermograph (skin-pencil). Next we locate the sensitive area from below and, when the latter is reached, it is also marked. It is wise to compare the sensitiveness on both sides of the spine although, as a rule, the neuralgia is unilateral.

The author makes exclusive use of freezing (page 172) for diagnostic and therapeutic purposes. The area to be frozen in neuralgia of a spinal nerve or nerves is that included between the two pencil marks just referred to.

It will be noted that if the mid-axilliary and sternal points of tenderness are marked with a pencil and freezing is executed at the vertebral point, the other points of tenderness disappear, or will be, at least, less sensitive after a single freezing.

This latter test is diagnostic of neuralgia of any of the spinal nerves. Several freezings, however, may be necessary before the neuralgia is cured.

In practically every case the author ever saw, when a diagnosis of neuralgia of a spinal nerve was made, the attending physician had applied his counterirritant at the site of the pain, *i. e.*, at the peripheral distribution of the nerve and not as he should have done near the site of the lesion, viz., the vertebral exit of the affected nerve.

If the negative pole of a Galvanic current is fixed at an indifferent spot, and the positive pole is placed successively over the other sensitive points, neuralgic pain is likewise inhibited, but this method cannot compare in accuracy nor in rapidity with the freezing method.

The author has often utilized the following method in the absence of a freezing apparatus; firm pressure is made with the thumb and maintained for several minutes at the vertebral area of tenderness. At first, the pains are accen-

tuated, but later they are mitigated or disappear. The method cited is used in an emergency and is decidedly less radical than freezing. Reference has been made to it on page 171.

It may happen, and indeed it often does, insomuch as cold is the common etiologic factor of neuralgia and muscular rheumatism, that both affections coexist. Here Faradism temporarily inhibits the pain of rheumatism, leaving the pain from other causes uninfluenced. Again, Faradism will accentuate the painful areas of muscular rheumatism.

Congelation (freezing) may be employed as a means of diagnosis for the following purposes:

A. To diagnose neuralgia of central from one of peripheral origin.
B. To differentiate neuralgia from neuritis.
C. To localize the lesion in neuralgia.

A. If a nerve the seat of neuralgia is frozen nearest its point of origin, the pain will disappear if the neuralgia is of peripheral origin and it will persist if of central origin. In the absence of spontaneous pain the painful points in the course of the nerve-distribution may serve as guides.

B. Freezing is a specific for all forms of uncomplicated neuralgia, provided it can be executed near the point of origin of the involved nerve, *i. e.*, close to the site of the lesion. If, however, the pain is central in origin or due to a neuritis, the pain, as a rule, will not be inhibited. Many years ago I suggested freezing for the pains associated with herpes zoster. In some instances it was marvelously efficient, but in the majority of cases, no relief followed. Here the pain was of central origin, due presumably to disease of the intervertebral ganglion.

C. The following cases illustrate the employment of freezing for localizing pain:

Case I. Male. In a row received many cuts on the scalp. Various cicatrices resulted. He suffered from ill-defined neuralgia located in the scalp. All cicatrices were equally sensitive to pressure. Freezing was conducted at the exit of the occipital nerves in the neck without effect. Then the individual scars were successively frozen during a paroxysm. Pain continued until one cicatrix in the occipital region was frozen, when the pain ceased at once. Excision of the latter cicatrix resulted in cure.

Case II. Case of occipital neuralgia. Usual painful points. Freezing conducted during a painful paroxysm. When freezing was made over a particular sensitive point the pain ceased. Palpation at this point demonstrated the presence of a little growth. Cure after removal of a small neuroma.

Case III. Neuralgia of the trigeminus (prosopalgia). Freezing during a painful paroxysm at the supra-orbital foramen, infra-orbital foramen and mental foramen respectively. Relief from the pain when congelation was conducted at the latter point. Examination of the teeth of the lower jaw showed the presence of a carious tooth, which, when extracted, was followed by a cure.

DIFFERENTIAL DIAGNOSIS.

Visceral diseases are frequently confounded with intercostal neuralgia. Here, as a rule, we find only a vertebral area of tenderness, whereas the mid-axillary and sternal points of tenderness are absent. Again, freezing at the vertebral area of tenderness is not followed by any relief of the pain. In visceral disease simulating intercostal neuralgia, one may demonstrate dermatomes (page 58) which, like the vertebral tenderness, become accentuated after palpation of special organs. Supposing, for example, one finds a

sensitive area over the stomach. If pressure sufficiently great is made at this point to induce pain, the area of vertebral tenderness in my experience, becomes accentuated and the dermatomes are more easily demonstrated.

In localizing the latter, however, one must not forget that hyperesthetic zones may also be demonstrated in neuralgia.

As a rule, in visceral disease, vertebral tenderness may be demonstrated on both sides of the spinal column, whereas, in intercostal neuralgia, the sensitiveness is unilateral. Bilateral sensitiveness in the latter affection suggests an *intravertebral lesion.*

Whereas, in intercostal neuralgia, pressure on the area of vertebral tenderness may reproduce the pains from which the patient suffers, in vertebral tenderness of visceral origin, like pressure may reproduce other symptoms. Thus arrhythmia may be reproduced or accentuated when the area of vertebral tenderness is firmly compressed. Similarly, in gastric disease, pressure on the sensitive vertebral area may cause eructations of gas and other symptoms suggestive of a gastric anomaly.

The aphonia and dysphonia of LARYNGITIS (acute) may be differentiated from like symptoms due to other laryngeal affections by the following simple method: First, mark with a pencil on either side of the neck the approximate point in the thyro-hyoid membrane where the internal laryngeal branch of the superior laryngeal, the nerve of sensation to the larynx, passes into the latter organ. Next, thoroughly freeze the points marked with the pencil. Relief is, as a rule, almost instantaneous and is of signal advantage to many professionals. In some instances, the restoration of the voice is of only short duration and freezing may have to be repeated several times.

The author desires to illustrate by the citation of a few

cases what he intends to convey by the phrase, pseudovisceral disease. In this respect he will be brief, for in this epoch of therapeutic skepticism, one dare not report phenomenal cures without being accused of extravagant representation, misinterpretation or, if the calumniator is charitable, of auto-suggestion.

PSEUDO-APPENDICITIS.

LUMBO-ABDOMINAL NEURALGIA which involves the six branches of the lumbar plexus is frequently mistaken for appendicitis. The author has observed many patients who had even contemplated an operation for the relief of their pain, but who were cured after one or several freezings at the vertebral exits of the sensitive nerves. One patient in particular is recalled who was seen in consultation, and who, despite the protests of the author, had his appendix removed. After the operation the persistent pains of a lumbo-abdominal neuralgia were cured by several freezings.

These cases are not difficult to diagnose. Painful areas are located near the lumbar portion of the vertebral column, in the center of the iliac crests, over the symphysis in the hypogastric region, at the scrotum in the male and at the labium majus in the female.

Pain in these patients is also felt on the anterior surface of the thigh corresponding to the area of distribution of the lumbo-inguinal nerve.

Difficulty in diagnosis in these cases is often hampered by the fact that there is a circumscribed tonic spasm of the abdominal muscles in the ileocecal region which may be mistaken for a deep-seated intumescence.

We have long recognized the almost intelligent function of muscles whether displayed in fixing a diseased joint or spine, or in protecting an inflamed serous membrane. The fact is, that in spinal neuralgias, *spasm of the muscles* can almost

invariably be demonstrated and it is a nerve-root symptom. When the lesion, as in neuritis, is destructive rather than irritative, muscular atrophy and not spasm is the concomitant sign.

One would naturally conclude that a skilled diagnostician could not possibly err in mistaking a lumbo-abdominal neuralgia for appendicitis. In Paris, the author recently saw an American lady who was suffering from atrocious pains in the ileocecal region. She consulted some of the leading surgical and medical clinicians of Europe. All were unanimous in their conviction that she had appendicitis, and that an immediate operation was imperative and the only means of arresting the pains. An examination demonstrated the spasm of the abdominal muscles in the neighborhood of the appendix, which, at one point, was so circumscribed as to awaken the suspicion of a tumor. A point over the appendix was exquisitely tender. There were the usual tender points elsewhere in the gluteal region, on the outside of the thigh, symphysis pubis and at the vertebral exits of the involved nerves. A single freezing gave immediate relief, although about ten freezings were necessary to effect a permanent cure. These patients often suffer a relapse, especially in inclement weather, but a single freezing suffices to cure. My only excuse for citing the latter case is to illustrate the frequency of pseudovisceral affections which are often erroneously interpreted by some of the best men in the profession. Verily, if the surgeon were a better diagnostician there would be less surgery.

PSEUDO-CEREBRAL DISEASE.

When a neuralgia implicates respectively the four superior cervical nerves, it is referred to as cervico-occipital neuralgia and the four inferior cervical nerves, as a cervico-brachial

neuralgia. In the former neuralgia, the major occipital nerve is most frequently involved and the pain is located in the neck and radiates along the occipital region as far forward as the eyes. There is practically always a spasm of the cervical muscles which interferes with the elicitation of pain upon deep pressure at the vertebral exits of the implicated nerve or nerves. Not infrequently, branches of the brachial plexus are similarly involved and the pains radiate down the arms. In cervico-occipital neuralgia, localized areas of sensitiveness may be detected notably at the external occipital protuberance and at the tip of the mastoid process. The latter point of sensitiveness has, in my experience, often been mistaken for a *mastoiditis* by enthusiastic aurists, yet a single freezing at the verterbal exits of the involved nerves will determine the nature of such forms of PSEUDO-MASTOIDITIS. Pseudo-mastoiditis is frequently mistaken for the true form of the disease if a discharge from the ear (otorrhea) is present.

When the pathologist makes an autopsy he records the many pathological conditions as anatomic diagnoses. The clinician should be similarly guided, but, unfortunately, he too often errs in tracing a connection between varying symptoms in his effort to include them all in a single diagnosis. Co-existing symptoms may be the expression of not only one but of several distinct diseases. The following case will amply illustrate the author's meaning: A gentleman having fallen from a ladder sustained an injury of the spinal column which resulted in a kyphotic deformity. Several weeks later he developed atrocious pains in his right leg which several orthopedists attributed to the original injury. Examination of the patient in question demonstrated a *sciatica* which had absolutely no connection with the primary traumatism and after several freezings over the region of

the nerve, the pains subsided completely and have ceased to reappear after several years, notwithstanding the persistence of the spinal deformity.

About four years ago one of my tabetics returned from Europe suffering from severe pains in the head which several specialists had told him were dependent on a cerebral lesion. The pains resisted conventional treatment. Examination of the patient, who returned to San Francisco in despair and without relief, demonstrated the presence of a cervico-occipital neuralgia. The localized areas of sensitiveness on his scalp disappeared after a single freezing at the vertebral exits of the involved cervical nerves and cure resulted after a thorough repetition of the procedure.

A lady with pains in the left half of the abdomen consulted several gynecologists, all of whom discovered a prolapsed ovary and suggested its removal. The pains due to a lumbo-abdominal neuralgia continued after the operation and were cured after several freezings at the exits of the involved nerves.

PSEUDO-ANGINA PECTORIS.

An intercostal neuralgia is frequently misinterpreted for angina pectoris. In the latter affection pains radiate to the neck and arm. The investigations of Head and Mackenzie show the following:

1. In cardiac and aortic disease, the pain is referred along the 1st, 2nd and 3rd dorsal nerves.
2. In angina pectoris, the pain in addition may be referred from the 5th to the 9th dorsal nerves.

The forms of anginal pains referred to in this connection are not concerned with functional angina pectoris observed in neuroses, but are distinctly traceable to a neuralgia of the intercostal nerves.

Pseudo-Arrhythmia

About fifteen years ago an elderly individual was referred to me by an Eastern physician with a diagnosis of angina pectoris. Several prominent clinicians had made a similar diagnosis. Like in true angina, the common exciting factor in provoking a paroxysm of pain in this patient was exposure to cold. Despite the concomitant symptoms which suggested the correctness of the diagnosis, the patient was examined for the signs of intercostal neuralgia which could easily be demonstrated. A few freezings at the vertebral exits of the involved nerves sufficed to rid the patient of his pains which, up to the time of writing, have not recurred.

PSEUDO-ARRHYTHMIA.

An irregular heart may be clinically manifested as an intermission when one or more beats of the heart are dropped, or, as an irregularity, when the beats show inequality in volume and force. The causal classification of Baumgarten is as follows:

1. Organic cerebral affections.
2. Reflex from visceral diseases.
3. Toxic, from tobacco, coffee, tea and from drugs like digitalis, belladonna and aconite.
4. Changes in the heart.

Arrhythmia may exist for a long period without symptoms. It is usually in connection with other cardiac signs that its presence is noted. Associated with myocardial or valvular lesions it is ominous, but as a permanent condition, secondary to mental influences, it is usually without significance. Irregularity of the heart-rhythm may give no expression in the pulse. The purely neurogenic type of irregularity observed in healthy children and young adults is due to overaction of the vagus. When the latter is paralyzed by atropin (grain 1-120 to 1-60), the pulse becomes

regular. Heart intermittency is differentiated from simple irregularity, by the fact, that, in resumption of the cardiac contractions they are regular from the beginning.

The author has demonstrated that, in the norm during the time the pulse is palpated, firm pressure made at the exit of the spinal nerves (preferably at the sides of the upper dorsal vertebræ), will result in decided alteration in the character of the pulse which often amounts to inhibition of the latter. In a few instances a decided arrhythmia may be observed.

The observations of the author have taught him that a neuralgia of the upper intercostal nerves is not an infrequent etiologic factor in arrhythmia notwithstanding the fact that, this cause is unrecognized in the text-books.

In intercostal neuralgia associated with arrhythmia, pressure on the sensitive areas corresponding to the exits of the involved nerves will accentuate the condition, and, if absent, will provoke it.

In such instances of arrhythmia, a single freezing at the vertebral exits of the involved nerves will often arrest the trouble at once. Arrhythmia may also exist as a result of a nerve-root lesion of the upper group of dorsal nerves without any symptoms of intercostal pains.

PSEUDO-ESOPHAGISMUS.

The following case, selected from many cases of a similar nature, is interesting as a paradigm of this condition. The patient, a female, has suffered for months in consequence of painful deglutition and is very much emaciated in consequence of her difficulty in swallowing not only solid foods, but liquids. An examination was negative beyond pain on pressure in the cervical region with sensitive cervical vertebræ on percussion. There were no symptoms of hysteria. The

dysphagia disappeared completely after three applications of the freezing-spray to the region of the sensitive cervical nerves.

PSEUDO-NEPHROLITHIASIS.

The patient, a physician, had suffered for many years from pains in the lumbar region on the right side occurring in paroxysms and simulating the pain of renal colic. An exploratory incision down to the kidney was made by an eminent surgeon of Philadelphia, and nothing was found. When the patient came to me his pain still persisted. The first and second lumbar vertebræ were sensitive to percussion and areas of vertebral sensitiveness were located to the right of the spinal column. Successive freezings of the paravertebral area of sensitiveness checked the painful paroxysms completely.

PSEUDO-DYSPEPSIA.

There are many cases which I have denominated *fictitious dyspepsia*, which are comparatively frequent and are associated with involvement of the spinal nerves. The patients may exhibit all the symptoms of dyspepsia, yet the presence of the painful areas of sensitiveness of an intercostal neuralgia are demonstrable. These cases, like the others, yield to freezing.

PSEUDO-CHOLELITHIASIS.

About several months ago several surgeons had made the diagnosis of gall-stones in an adult male, who for several years had suffered from paroxysmal pains in the region of the gall-bladder. Before submitting to an operation he decided to consult three medical clinicians. We also concurred in the diagnosis. The author was reluctant to question the diagnosis for the reason that the severe paroxysms of pain necessitated the use of morphine. When pain is severe

enough to necessitate an analgesic so powerful as morphine (in the author's experience) intercostal neuralgia can be excluded. On the following day, the patient in question was re-examined and the areas of sensitiveness peculiar to intercostal neuralgia could be demonstrated. About ten freezings over the vertebral exits of the implicated nerves sufficed to completely rid the patient of his paroxysms of pain. In fact, after the first freezing, the painful area located near the gall-bladder was no longer sensitive to pressure.

The author has seen a number of such cases and one case in particular is recalled, where jaundice accompanied the painful paroxysms. The jaundice in the latter case could be explained by the fact that respirations on the affected side were limited. It is well-known that the bile is secreted under very low pressure and that the diaphragm in contracting, subjects the liver to pressure which is an active factor in forcing the bile from the smaller to the larger biliary ducts. Interference with the movements of the diaphragm is likely to cause icterus of resorption.

PSEUDO-MAMMARY NEOPLASMS.

As before remarked, neuralgia of the intercostal nerves is associated with a circumscribed tonic spasm of muscle and, if the neuralgia involves the nerves in juxtaposition to the mamma, the pain and intumescence suggest a neoplasm. In such instances, an error is unavoidable, unless the physician recalls the fact, that *mastodynia* may be a variety of intercostal neuralgia.

CHAPTER VII.

THE CIRCULATORY SYSTEM.

THE HEART REFLEX—CARDIAC SUFFICIENCY—DIFFERENTIAL TABLE OF ASTHMA—TESTS FOR HEART-SUFFICIENCY—ANGINA PECTORIS—THE HEART REFLEX OF DILATATION—DIFFERENTIAL TABLE OF TRUE AND FALSE ANGINA—FUNCTIONAL AFFECTIONS OF THE HEART—INHIBITION OF THE HEART—PHYSIOLOGY AND PATHOLOGY OF THE BLOOD-VESSELS—BLOOD-PRESSURE—VASO-MOTOR FACTOR IN BLOOD-PRESSURE—SPHYGMOMANOMETRY—HYPERTENSION AND HYPOTENSION—THE AORTIC REFLEXES—ANEURYSM OF THE THORACIC AORTA—THE VASO-MOTOR APPARATUS—VASO-MOTOR NEUROSES.

THE HEART REFLEX.

ATTENTION was first directed in 1898 to the phenomenon[52] now known as the heart reflex of Abrams. The reflex in question is a contraction of the myocardium of varying duration, which results when the skin of the precordial region is irritated. The cutaneous irritant may be a spray of ether directed over the region of the heart, or the skin may be rubbed with a blunt instrument, or by means of an ordinary pencil eraser, or by a series of percussion blows. The nearer the irritant is applied to the precordial region and the more vigorous the cutaneous friction, other things being equal, the more pronounced is the heart reflex. The reflex is best observed with the Roentgen rays with the fluorescent screen approximating the anterior chest-wall. The reflex is, as a rule, more manifest in the left than in the right ventricle, and the contraction of the myocardium is not always sudden and of momentary duration; on the contrary, its duration in children, on whom most of the original observations were made, is not less, as a rule, than

two minutes, and, furthermore, the myocardial recession continues even after the source of cutaneous irritation is removed. The degree of myocardial recession (heart reflex) varies greatly. In some persons it is scarcely perceptible, while in other individuals the heart may recede more than 2 cm. on either side upon the first application of the cutaneous irritant (Fig. 54).

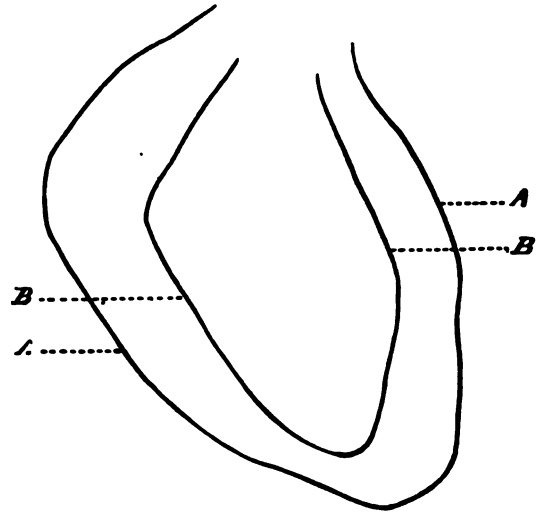


FIG. 54.—Heart reflex in a boy, aged eight years. Duration of reflex two and a half minutes. The normal outline of the heart drawn on the fluoroscope is represented by A, whereas B represents the outline of the heart after cutaneous irritation and shows the degree of myocardial recession of the heart reflex.

In other instances, although the reflex is practically never absent in the norm, it is strictly confined to the left ventricle, as shown in Fig. 55.

In individuals with dilated hearts the reflex is very evident and is of much longer duration than in healthy hearts. This latter observation, as we shall learn presently, has been confirmed by the careful observations of Merklen and Heitz.

In the original communications concerning the heart

reflex, the latter was only observed in the transverse cardiac diameter, but with the x-rays it can also be seen in the sagittal diameter. Subsequent observations demonstrated that the heart reflex could be elicited by irritation of more remote regions, viz.:

1. Irritation of the nasal mucosa.
2. Irritation of the gastric mucous membrane.
3. Irritation of the rectal mucosa.
4. By irritation of the esophageal mucosa in the act of swallowing.
5. By percussion of the muscles.
6. By psychic influences.
7. By vertebral concussion.

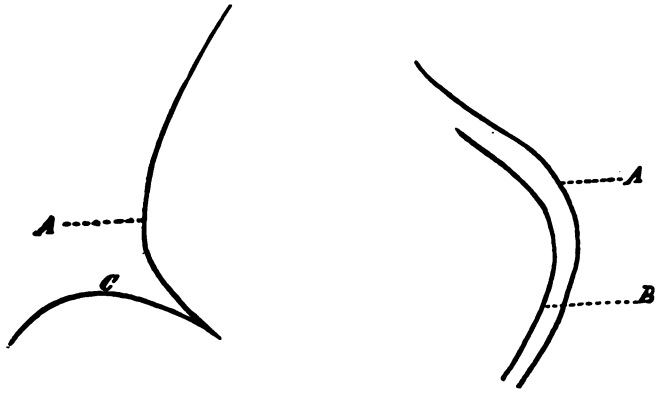


FIG. 55.—Heart reflex in a boy, aged fourteen years. Duration of reflex, fifteen seconds. A represents the cardiac outline before, and B after, cutaneous irritation, while C represents the upper border of the liver.

IRRITATION OF MUCOUS MEMBRANES.—Here investigations were conducted during the time the x-rays were traversing the chest, and by means of the fluoroscope the heart was directly observed. It was noted that, when irritating vapors were inhaled there was a decided recession of the cardiac ventricles (heart reflex), especially the left, and that this heart reflex was more pronounced than when

excited through the skin of the precordium. Ether and chloroform inhalations also excite the reflex and in a few instances, these vapors produced a veritable cardiac inhibition. It was noted that, the reflex in question was excited by irritation in succession of the nasal, pharyngeal and laryngeal mucous membranes, and when the latter were made anesthetic by cocain, no heart reflex could be elicited.

The accompanying sphygmogram (Fig. 56) shows a decided difference in the output into the general circulation before and after the inhalation of ammonia.

The heart reflex may also be elicited by irritation of the gastric mucosa when the sponge of the gyromele is made to

FIG. 56.—Sphygmogram of the radial artery; A before, and B after, the inhalation of ammonia.

revolve against the membrane in question. One may also excite the reflex by irritation of the rectal mucosa by means of the finger in the rectum.

PERCUSSION OF THE MUSCLES.—If one percusses the muscles (*tapotement*) of the extremities, one can elicit the cardiac reflex. The latter is essentially a reflex of muscular

to percuss the muscles of one arm by means of a percussion-hammer. Following the manœuver the right ventricle shows considerable retraction. The effect on the systemic blood-pressure by percussion of the muscles is very slight, and this is obvious, considering that the left heart-ventricle is uninfluenced by the manœuver.

PSYCHIC INFLUENCES.—We have always recognized the influence of emotions on the heart, but no tangible evidence of such effects has been demonstrated. The epigram of Peter is worth repetition: "The physical heart is the counterpart of a moral heart." The conventional expression of the frightened individual, "My heart was in my mouth," finds justification by an x-ray study of the organ. Inform the patient standing before the x-rays, that you are going to burn him with a hot iron or frighten him in some other way, and the effect on the heart is at once manifested. It is a veritable *psychic heart reflex* implicating the entire organ. The heart becomes very much reduced in size, and appears as if it were retreating towards the neck. I know of no irritation, cutaneous or otherwise, that is so pronounced as this psychic factor of fright in inducing the heart reflex. The foregoing fact is of the utmost importance in eliminating emotional influences in the treatment of cardiac diseases. Even in an ordinary x-ray examination of the heart, one may observe in nervous patients a reduction of the heart-mass. Mr. Bezley Thorne[53] observed that the heart shrank after exposure to the Roentgen rays. It is evident that the shrinkage thus observed, was naught else but a cardiac reaction (heart reflex) to emotional influences, for an x-ray examination to the average patient is a momentous procedure.

The author has frequently witnessed the pulmonary reaction of fright; the lungs became hyperresonant on percussion and the superficial areas of cardiac, hepatic and

splenic dullness became diminished, a condition which the author has called the *psychic lung reflex of dilatation*. The latter psychic reflex may be easily demonstrated, if the areas of the organs in question are first outlined, and later if the patient is frightened, percussion will demonstrate that the areas of the organ are reduced in proportion to the psychic reaction which provokes a dilatation of the lungs.

VERTEBRAL CONCUSSION.—Perhaps the most effective method of provoking the heart reflex is by means of concussion of the spinous process of the 7th cervical vertebra. It will be noted that this refers to the heart reflex of contraction, for there is still another heart reflex which is to be described presently, known as the heart reflex of dilatation.

PRACTICAL VALUE OF THE HEART REFLEX.—Percussion of heart, or, for that matter, any other organ adjacent to the lung, is associated with many errors unless one takes into consideration the *lung reflex*.

Percussion of the heart, as executed ordinarily, yields an absolute or superficial, and a deep or relative dullness. Practically little or no value can be attached to the superficial dullness in estimating the size of the heart, as it varies with the position of the overlapping lung-borders. Even the lightest percussion blow will provoke sufficient cutaneous irritation to induce the lung reflex of dilatation, *i.e.*, an acute dilatation of the lungs which may diminish the area of superficial cardiac dullness, even to obliteration. Cabot,[54] in his classical book, makes the following observation: "Anyone who has demonstrated an area of percussion dullness to many students in succession must have noticed occasionally that the more we percuss the dull area the more resonant it becomes, so that those who last listen to the demonstration, the difference which we wish to bring out is much less obvious than to those who heard the earliest percussion

strokes. Abrams has referred to this fact under the name of the *'lung reflex.'* " Sahli, in his "Diagnostic Methods," refers to the same fact. The mere influence of room temperature materially changes the results of percussion. Let any one, after percussing the areas of superficial dullness, direct a current of cold air, *e.g.*, from an atomizer, over the regions percussed, and the result will be diminution or obliteration of the areas in question. It is evident from what has preceded that, while the heart reflex can always be determined by the x-rays, after cutaneous irritation of the precordium, mere percussion of the superficial area of cardiac dullness cannot determine its existence because the irritation necessary to evoke the heart reflex will also induce the lung reflex, which must necessarily mask the heart reflex.

Thus the observations of Schott and others, who seek to demonstrate the effects of carbonated baths on the heart by percussion of the latter organ are evidently erroneous unless such percussion takes into consideration only the deep or relative cardiac dullness. Heitler[56] perpetrates the same error by failing to take into consideration the coincident lung reflex when making cutaneous irritation. Heitler seeks to determine the sufficiency of the heart muscle by a series of percussion blows over the heart region. If, thereafter, the cardiac dullness is much diminished, it is an evidence, he argues, that the cardiac musculature is sufficient, for the tendency of the normal muscle tonus of the heart is to maintain a limited patch of dullness. As before remarked, the heart reflex can be observed directly with the rays, but if strong percussion is employed so that reliance is alone placed on the deep or relative cardiac dullness, the reflex in question may be determined by percussion. Heitz,[57] in discussing "Le Reflexe Cardiaque d'Abrams," observes that, while in the normal subject the heart reflex is of short dura-

tion, in cardiectasis it may persist for several hours. In the third edition of their valuable book ("Examen et Séméiotique du Cœur"), Merklen and Heitz show graphically the effects

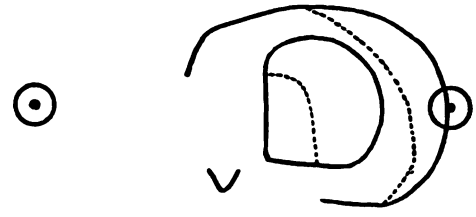


FIG. 57.—Cardiac reflex in a neurasthenic with functional troubles of the heart; reduction of the absolute and relative dullness. (After Merklen and Heitz).

of friction of the skin in the region of the heart of a cardiac neurasthenic (Fig. 57), and in a cardiopath with hyposystolie (Fig. 58).

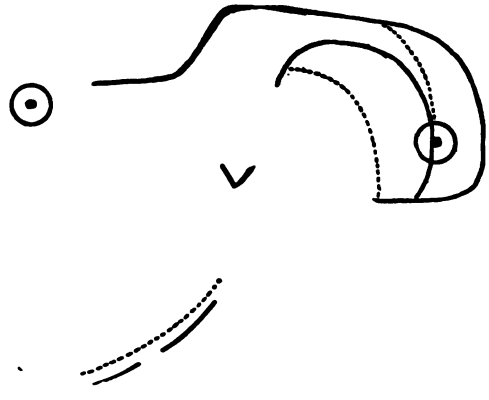


FIG. 58.—Hyposystolie in an arteriosclerotic; reduction of the absolute and relative cardiac dullness and ascension of the inferior border of the liver under the influence of precardial massage. (After Merklen and Heitz).

In Fig. 58 the reduction of the hepatic dullness is shown following the friction of the skin; the continuous lines show the superficial and the deep dullness of the heart before, and the interrupted lines the reduction of the areas after friction of the skin.

All physicians do not possess equal skill in determining the relative cardiac dullness, and I have devised a simple apparatus called the "Vibrosuppressor," which serves to simplify topographical percussion (page 80).

The Heart Reflex of Nasal Genesis.—Reference has already been made to the fact that the heart reflex can be provoked by irritation of the nasal, pharyngeal, and laryngeal mucous membranes, and that if the irritation is sufficiently prolonged and violent the movements of the heart may be inhibited. If the membranes in question have been previously cocainized the heart reflex cannot be elicited. It is evident, then, that previous cocainization of the nasal and pharyngeal mucous membranes should precede the employment of an anesthetic. On theoretical grounds, the laryngeal mucosa should not be cocainized, as it is necessary to preserve the laryngeal reflex to prevent the entrance of foreign substances into the larynx.

The Heart Reflex of Gastric Genesis.—Knowing that irritation of the gastric mucosa will provoke the heart reflex, it is not improbable that sudden death of gastric origin may be caused by reflex inhibition of the heart. In instances of this kind the fact of a dilated stomach directly compressing the heart cannot be ignored. I have studied, by aid of the x-rays and the fluoroscope, the action of a dilated stomach on the heart by artificial distension of the stomach. The healthy heart can tolerate considerable compression and dislocation without modifying the intensity of the heart tones, but when the organ is diseased, the slightest compression and dislocation is followed by evil consequences. Artificial insufflation of the colon will also compress and dislocate the heart, but never in the same degree as will insufflation of the stomach (Fig. 33).

The Heart Reflex of Rectal Origin.—Irritation of the

rectal mucosa will also induce the heart reflex. Straining at stool in elderly people by increasing intraabdominal pressure, and thus putting a strain on the cerebral vessels, predisposes to rupture of the latter. Straining, however, is not wholly a question of pressure. Some patients, particularly those with weak hearts, suffer from collapse symptoms while straining at stool. In investigating the cause of such symptoms, I found that contraction of the abdominal musculature will cause even in the norm a veritable weak heart reflex with diminished output of blood from the left ventricle. For the latter reason the amount of blood is decreased in the arterial system and

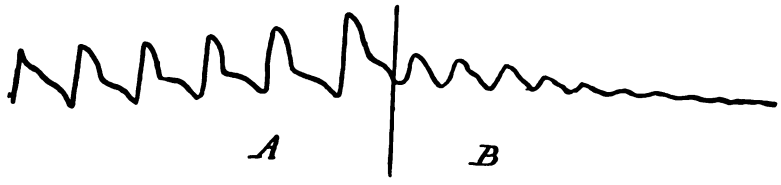


FIG. 59.—Sphygmogram (A) before and (B) while straining at stool.

increased in the veins. The accompanying sphygmogram (Fig. 59) illustrates the effects of contraction of the abdominal musculature on the heart.

It is evident that if the heart is enfeebled the effects of such cardiac inhibition may be attended with serious results. It is well known that different nerves from the abdomen and

heart if the radial pulse is palpated during contraction of the abdominal muscles while straining at stool.

Relative Valvular Insufficiency.—The normal heart can easily adapt itself to the average grades of dilatation such as occur during exertion; in fact, the size of the cavities of the heart varies even in health, and a dilatation is physiologic as long as the heart cavity is capable of emptying its contents during systole. What is called "getting wind" in climbing a mountain or in athletic training is practically a moderate dilatation of the cavities of the right heart. In relative valvular insufficiency the valves are normal, but they are no longer capable of completely closing the orifices of the heart. This condition is frequent after heart strain and involves particularly the tricuspid valves. A murmur which is heard in such instances may be made to disappear temporarily by inducing the heart reflex, which, by causing myocardial contraction, reduces the size of the cardiac orifices, thus enabling the valves to close the openings. Here the excitant of the heart reflex must be vigorous and for this purpose the sinusoidal current, with both electrodes to the precordial region, is most efficacious. Percussion of the precordial region with a percussion hammer will often suffice.

Pericardial Effusion.—The differential diagnosis between a dilated heart and a pericardial effusion is often conceded to be a difficult clinical problem. From what has preceded the heart reflex can be employed in diagnosis. The reflex in question is absent in pericardial effusions and present in cardiectasis. In other words, after the heart reflex is provoked the area of deep cardiac dullness will be uninfluenced in effusions but modified in cardiectasis.

It may be difficult to say whether a *pulsating intrathoracic mass* examined with the X-rays is the heart or an aneurysm. A retraction of the mass after provoking the

heart reflex would indicate that it is the heart and not an aneurysm. Cooper utilized the foregoing fact in differential diagnosis. I will not now attempt to discuss the therapeutic value of the heart reflex, but it is my personal opinion that the carbonated baths in the Schott treatment possess no special effect beyond their action in provoking the heart reflex by cutaneous irritation and that cutaneous friction by any other method is equally efficacious. The foregoing conclusion is formulated only as a result of many years of observation. Massage of the precordial region or the employment of the sinusoidal current, especially in cardiopaths, will reduce the area of the heart and the pulse-rate and augment blood-pressure. The now prevailing fetish in cardiotherapeutics is Nauheim. I subscribe equally to the efficiency and deficiency of this famous resort, but it is puerile to endow its waters with marvelous attributes.

CARDIAC INSUFFICIENCY.

One frequently observes in a large number of individuals at about the period of middle-age, definite signs of cardiovascular disturbances even though no valvular lesions are present. Here the condition is due to some change in the heart-muscle which has not been definitely established even by the microscopist. This condition has been popularly designated as heart-failure or heart-weakness, and others speak of the condition as chronic cardiac insufficiency or incompetency.

The signs of *incompensation* vary according to whether they are caused by a lesion of the valves or occur independently of the latter and are dependent on changes in the myocardium. All diseases of the heart, whether of the valves or myocardium, lead eventually to disturbances of circulation. The phenomena associated with the latter are easier of interpretation if we study the effects of valvular lesions.

Cardiac Insufficiency

The compensatory mechanism of the heart illustrates why cardio-vascular disease is not at once followed by disturbances in the circulation. The normal heart can easily adapt itself to the average grades of dilatation such as occur during exercise. In fact, the size of the cavities of the heart varies even in health, and a dilatation is physiologic as long as the heart-chamber is capable of emptying its contents during systole. Any increased work on the part of the heart, if continued, leads to an increase in the size and number of the muscle-fibers, a condition known as ***hypertrophy***, which enables the organ to contend with additional burdens.

Although a valve-lesion may be of some significance in prognosis, yet the essential factor always is the question of compensation.

Valvular lesions are of two kinds, narrowing of the valve-openings (stenosis), and incomplete closure of the orifices (incompetency or regurgitation) due to retraction of the valves. In either condition dilatation of one of the chambers of the heart occurs because it is always distended with blood, and incompletely discharges its contents at systole. When the heart hypertrophies, to overcome the latter defect, and thus prevents stasis in any part of the blood-current, the lesion is compensated. Thus compensation is practically dependent on the condition of the heart-muscle. If the heart fails to hypertrophy, or if the latter has occurred and it is subjected to burdens beyond its capacity, or in consequence of degenerative changes, the heart fails as a motor and it becomes insufficient, or, as is often said, compensation is broken or ruptured. In consequence of incompetence, a diminished quantity of blood is pumped into the arterial system, hence the arterial pressure is decreased, venous pressure is increased and the current of the blood in the capillaries is retarded.

The cavities of the ventricles dilate because they cannot discharge their contents (increased area of cardiac dullness). Overloading of the veins conduces to the collection of fluid in the tissues which begins primarily in the feet and gradually invades the other parts of the body.

Cyanosis of the skin is an early symptom and appears as soon as there is a disturbance in the pulmonic circulation.

In children, a lesion of a valve retards development and nutrition and produces a condition known as *cardiac cachexia*.

The pulse is often characterized by intermittency and is caused by feeble contractions of the heart which are not strong enough to drive the blood to the radial artery. In such instances, if the heart is auscultated synchronously with palpation of the pulse, there are more heart-tones than pulse-beats.

DYSPNEA in disease of the heart is out of all proportion to the physical changes in the lungs and is caused by pressure of the enlarged heart on the lungs, disturbed pulmonic circulation, hydrothorax, ascites, or bronchial catarrh.

CARDIAC ASTHMA may be confounded with asthma of bronchial origin and the following table will assist in differential diagnosis:

DIFFERENTIAL TABLE OF ASTHMA.

CARDIAC ASTHMA.	BRONCHIAL ASTHMA.
Signs of cardiac disease.	Usually absent.
Dyspnea is equally inspiratory and expiratory.	Dyspnea is expiratory.
Pulse in the early stage of paroxysm may be strong, but it soon becomes soft and small.	Pulse-tension usually increased throughout the paroxysm.
Percussion shows an extension of the borders of the lungs and obliteration of the area of superficial cardiac dullness.	Extension of lung-borders more pronounced.

CARDIAC ASTHMA.	BRONCHIAL ASTHMA.
Auscultation shows an absence of *râles* unless complicated by lung-edema.	Sonorous and sibilant *râles* are always heard and are loudest during expiration.
Tracheal traction-test is positive.*	Tracheal traction-test, negative.
Cardiac stimulation will inhibit attacks and cardiotonic medication will prevent them.	No special results from cardiac stimulation.
Tests show cardiac insufficiency (page 215).	No cardiac insufficiency unless heart-weakness exists as a complication, and then the right heart is usually compromised.
Concussion of the 7th cervical vertebra may arrest an attack at once by provoking the heart reflex (page 199).	Very frequently the attack can be subdued by concussion of the 4th and 5th cervical vertebræ (page 313).

Cardiac insufficiency due to *myocardial disease* may be divided into three main groups, which are as follows:

1. An arrhythmic form, in which the pulse is irregular and intermittent and lacks force and volume.
2. A group characterized by acceleration of the pulse (*tachycardia*) and paroxysms of palpitation.
3. An asthmatic group, which is characterized by attacks of acute pulmonary edema and cardiac asthma.

Usually the patients are middle-aged men of strong physique who have eaten to excess and have taken very little exercise.

The frontier symptoms of cardiac incompetency in such

*The author has described this test as an aid in the diagnosis of idiopathic asthma.[50] When the head of a patient is thrown forcibly backward, the normal resonance obtained by percussion over the manubrium sterni and lungs contiguous thereto becomes converted into a dull or flat sound. This manœuver is the tracheal traction-test. It is positive in health and in all cardiopulmonary affections, excepting in idiopathic asthma. In other words, in the latter affection, the pulmonary resonance over the manubrium is unchanged when the head is thrown backward. The explanation of this phenomenon is discussed on page 311.

individuals are slight difficulty in breathing on exertion in ascending stairs and in walking up a slight hill. The individual may observe that, after a hearty meal there is a feeling of uneasiness or a dull pain in the region of the heart. These symptoms continue to become more pronounced and are not infrequently associated with attacks of fluttering or palpitation of the heart.

One may also observe in these cases signs of arteriosclerosis.

Percussion shows as a rule an increase in the area of cardiac dullness which may involve either ventricle or both.

Respecting the prognosis in cases of cardiac insufficiency, it is usual to regard the cases as hopeless and that little can be done to patch up the crippled heart.

The author, however, finds that provided a good heart reflex can be obtained, the prognosis is, as a rule, favorable. In this regard one may cite the observations of Heitz who shows that, the heart reflex of Abrams is a good guide by which to determine the probable effect of contemplated balneologic treatment. If the size of the heart does not change under the excitation of the reflex, by sharp blows over the precordial region, the treatment will be ineffectual or may even be contra-indicated on account of the probable development of cyanosis. In very large dilatations and in advanced myocardial degeneration, the heart does not respond to precordial excitation and is not favorably influenced by baths. If the reaction is feeble, good results may be achieved, but the treatments must be used cautiously. Since the author has employed concussion of the spine of the 7th cervical vertebra for provoking the heart reflex, decidedly better results can be achieved from treatment than by mere precordial excitation which has heretofore been practiced.

It may be remarked, that while the x-rays furnish the best proof of the amplitude of the heart reflex, yet results may be achieved by percussion, if the vibrosuppressor is employed as an aid (page 80). Here one percusses the heart to obtain the deep or relative cardiac dullness and the limitations of the organ are carefully marked with a pencil. Next, one rubs vigorously the skin over the region of the heart, or, better still, one strikes a series of concussion-blows upon the spinous process of the 7th cervical vertebra and percussion of the heart is again executed; any diminution in the area of cardiac dullness indicates the amplitude of the heart reflex.

TESTS FOR HEART-SUFFICIENCY.

In disease of an organ, the severity of a lesion is generally gauged by the incapacity of the organ to execute its functions. Thus it is, that in affections of the kidney, the percentage of albumin in the urine is of minor prognostic importance, provided the nitrogenous excretion is relatively normal.

Similarly, in affections of the heart, a *murmur* is of no value in determining the prognosis of any given case, inasmuch as some of the most serious affections of the heart are unaccompanied by murmurs.

In the presence of a cardiac disease, whether of the valves or of the muscle of the heart (myocardium), it should be the primary endeavor of the physician to determine the functional capacity of the organ. Many functional diseases of the heart, described as *cardiac neuroses* are mere instances of heart-fatigue, for the heart like the skeletal muscles will tire when an additional burden is cast upon it; in fact, the heart may be the most vulnerable muscle in exhaustion.

We have already noted (page 203) the effects of emotions on the heart and among neurasthenics, emotional influences

must be regarded as additional etiologic factors in superinducing heart-fatigue.

There are many individuals, notably women, labeled as neurasthenics, who are really sufferers from cardiac incompensation.

To determine the vigor of the myocardium, the conventional physical methods of examination furnish little practical aid, hence recourse is had to any of the following manœuvers:

1. THE PULSE METHOD.—The pulse of the cardiopath is altered in character after body-movements and physical exertion in a more pronounced manner than in health, and such alteration is in proportion to the insufficiency of the heart-muscle. When the heart is healthy and one counts the pulse first in the erect and again in the recumbent posture, a retardation of the pulse in the latter position from 10 to 12 beats per minute is observed. In disease of the heart-muscle, however, retardation of the pulse in the recumbent posture becomes less and less conspicuous, the greater the degree of cardiac insufficiency, until in pronounced grades of the latter, the frequency of the pulse may even be greater in the recumbent than in the erect posture.

2. BLOOD-PRESSURE METHOD.—This method (like the two following methods) requires the use of a blood-pressure instrument (*sphygmomanometer*, page 244). It is known that muscular work is associated with alterations in the arterial blood-pressure. In health muscular exertion increases the blood-pressure, but, if the heart is insufficient, this rule is reversed, *viz.*, muscular exertion will reduce the blood-pressure. The less evident the rise in pressure after exercising the muscles, and the deeper the remissions of the blood-pressure curve and the less muscular exercise it takes to produce such remissions of pressure, and the longer it

takes for the blood-pressure curve to attain the normal, the greater is the functional incapacity of the heart.

3. METHOD OF KATZENSTEIN.—After determining the blood-pressure and the pulse on the reclining patient, both of the femoral arteries are compressed with the middle finger of each hand at Poupart's ligament, the other fingers testing whether the compression is absolute. With normal heart-energy the blood-pressure then rises by from 5 to 15 mm. mercury, while the pulse remains unaffected or drops. When the compression is relinquished, the blood-pressure gradually returns to normal. A slightly enfeebled heart is not able to raise the blood-pressure when the obstruction to the circulation is interposed, and with a much enfeebled heart the blood-pressure actually sinks under the compression, while in both events the pulse becomes more or less accelerated. The respiration is kept superficial during compression.

4. HEART REFLEX METHOD.—After taking the blood-pressure, fix over the heart-region a pleximeter and strike the latter a series of vigorous blows with a hammer (Fig. 2), after which immediately take the pressure again. If the myocardium is sufficient, the blood-pressure remains the same or rises; otherwise, it falls, and the rise and fall are in proportion respectively to the vigor and insufficiency of the heart-muscle, *e.g.:*

BLOOD-PRESSURE BEFORE AND AFTER EXCITATION OF THE HEART-REGION.

BEFORE.	AFTER.	CONCLUSION.
120 mm.	140 mm.	Myocardium very strong.
135 mm.	138 mm.	Myocardial sufficiency.
190 mm.	155 mm.	Myocardial insufficiency.

Concussion of the heart region elicits a maximum heart reflex with a temporary augmentation of vigor if the myocar-

dium is normal, otherwise, the stimulation is in the nature of a shock.

TREATMENT OF CARDIAC INSUFFICIENCY.

One must concede the phenomenal results achieved in cardiotherapeutics since the inauguration of the Schott methods by saline baths and resisted movements in failing heart-power. If the Schott methods of treatment are effective, their efficiency is recognized by the following results:

1. A sensation of warmth.
2. Augmented pulse-volume with diminished frequency.
3. Stronger cardiac systole.
4. Diminished area of cardiac dullness.
5. Amelioration of precordial distress.
6. A feeling of well-being.

There are many theories concerning the action of the saline baths and resisted movements, but in the opinion of the author, the theory that best responds to reason is that which supposes their action to be due to the elicitation of the heart reflex. From what has been said concerning the latter reflex (page 199), it is known that cutaneous stimulation of any kind will result in a vigorous contraction of the heart-muscle. Hence, mere friction of the skin with a coarse towel is equally as efficient as the waters of Bad Nauheim, in Germany, which owe their action to various chlorid salts and to the presence of carbonic acid.*

In studying the amplitude of the heart reflex (Fig. 54), when elicited from various regions of the organism, the

*"Dr. Bloch, of Franzensbad, uses carbonic acid douches for producing contraction of the heart, based on the fact discovered by Dr. Abrams, of San Francisco, that friction of the precordial region will produce contraction of the heart (Satterthwaite)."

author is justified in concluding that the most effective site is the *spinous process of the 7th cervical vertebra*, and that the most satisfactory method for its elicitation, is by means of the pneumatic hammer (Fig. 50) or any similar apparatus giving a percussion stroke. In the absence of an apparatus, mere concussion by means of a pleximeter and hammer (page 8) may be employed.

The duration of each séance is governed by the results and one must not forget that a reflex may be exhausted as well as excited. My usual custom is to limit each séance to about five minutes with frequent periods of rest during the application of the percussion stroke. In the opinion of the author, the results achieved are more satisfactory and more rapid than by any other method of treatment.

Very frequently he has observed cardiopaths with severe dyspnea and other signs of heart failure, who obtained immediate relief after a single séance of concussion-treatment.

It is evident, however, that many séances are necessary before one may expect permanent results.

It is equally evident that concussion must not be employed to the exclusion of other methods of treatment in failing compensation, although the author has employed concussion exclusively in his cases to enable him to formulate conclusions respecting the efficacy of the method.

Reference to Figs. 60 and 61 shows the effects of concussion of the 7th cervical spinous process in two patients with dilated hearts superinduced by myocarditis. The relief following concussion is dependent on the duration of the heart reflex which, in turn, is dependent on the condition of the heart-muscle. In several instances of myocarditis no results were achieved by concussion, but in these cases the myocardium was past restitution.

When attacks of *cardiac asthma* (page 212) or other paroxysmal symptoms of heart-failure occur at the home of the patient, some competent member of the family is instructed to concuss the spinous process of the 7th cervical vertebra by means of the pleximeter and hammer.

FIG. 60.—The effects of concussion of the spine of the 7th cervical vertebra on the area of the heart in a patient with myocarditis. The continuous line represents the area of the heart before, and the broken line after, concussion.

FIG. 61.—The effects of concussion of the spine of the 7th cervical vertebra on the area of the heart and liver in a patient with advanced myocarditis. The continuous line represents the area of the heart and liver before, and the broken line after, concussion.

As a rule, the latter manœuver is followed by immediate relief of the symptoms.

As observed on a previous page (215), some patients owe their infirmity to heart-failure and many anemic women who respond unceasingly to the demands of an active social life, who say they are "worn out," often suffer from an overstrained heart. The subjective symptoms are lassitude, slight dyspnea on exertion and digestive disturbances.

Objectively, one may recognize dilatation of the ventricles by percussion, feeble heart-tones, and a pulse which is rapid and feeble and may be irregular or intermittent. These cases, as well as those hearts which fail to respond to the tests of cardiac sufficiency (page 215) are benefited by concussion-treatment.

ANGINA PECTORIS.

THE HEART REFLEX OF DILATATION.

Heretofore only one heart reflex was recognized, *viz.*, the heart reflex of contraction (page 199), but when the spinal processes of the 9th, 10th, 11th and 12th dorsal vertebræ are rapidly concussed in succession there is a decided increase in the area of cardiac dullness as obtained by percussion. This increase in the area of cardiac dullness is not associated, as the X-rays show, with any increase in the diameters of the heart. The latter fact corresponds with the investigations of Kornfeld, who demonstrated that the heart-muscle possesses the property of increasing the size of its cavities without any corresponding augmentation of tension of its walls, a condition which he calls *Ausweitungsfähigkeit.*

Among the theories of ANGINA PECTORIS, that of Allan Burns appeals most cogently to reason.

The latter assumes that, in consequence of a transient ischemia of the heart-muscle caused by disease or spasm of the coronary arteries, a condition analogous to intermittent claudication ensues. It is known that the coronary arteries are practically always diseased in fatal cases of angina, but if we accept the observation of Schäfer that the coronary vessels are unprovided with vasomotor nerves, the theory of intermittent claudication of the coronaries must necessarily suffer a serious setback unless supported by other evidence.

The coronary arteries supply the heart with blood only during diastole, for during systole the ventricular wall is so strongly contracted that the muscular tension becomes greater than the coronary pressure and so the coronary artery and branches are compressed and the blood is driven back into the aorta. It is our contention that the theory of Burns is correct, but that the ischemia is quite independent of the coronary arteries, which are merely passive structures. We assume that any factor operating to augment the tonicity of the cardiac musculature compresses the arteries in question and thus induces ischemia. The heart reflex is essentially a myocardial contraction and when the reflex is in evidence the coronary arteries are subjected to varying degrees of pressure. If in an attack of angina, the pulse shows augmented tension and is small and perhaps diminished in rate, or if syncope is observed, such symptoms are explainable by the heart reflex.

We know that when the reflex is in evidence, the heart is practically inhibited; there is a diminished output of blood into the general circulation and, if the pulse shows increased tension, it is only an expression of vaso-motor activity which assumes the burden of maintaining the circulation.

If one studies the etiology of angina, one notes that the factors which precipitate a paroxysm are also equally operative in inducing the heart reflex. Muscular effort is a potent factor which also provokes the *myopathic heart reflex.* Emotion is another prominent factor and led John Hunter to observe that "his life was in the hands of any rascal who chose to annoy and tease him." Emotion as a cause corresponds with the *psychic heart reflex.* A gust of wind striking the chest is equally involved in inducing either an attack of angina or the heart reflex.

Oliver demonstrated that patients who have suffered from

precordial pain obtain permanent relief on the supervention of cardiac dilatation and failure, and Broadbent has shown that the supervention of mitral insufficiency may diminish the tendency to anginoid attacks.

Now, in cardiectasis, while the heart reflex can be provoked, the cardiac musculature is enfeebled and the resulting pressure on the coronary arteries is correspondingly diminished. Reference has been made to the heart reflex of dilatation and in several instances, during my office hours, I have inhibited anginoid pains by concussion of the vertebræ which induces cardiac dilatation, and I have employed the same method with fairly good results in the treatment of angina pectoris. In other instances, I have unintentionally provoked attacks of angina in studying the heart reflex and the methods for its elicitation.

Here concussion of the spinous process of the 7th cervical vertebra is often effective in developing some of the symptoms of angina pectoris when absent and the same may be said of concussion of the precordial region. Thus, concussion from either region is a diagnostic sign of some importance and serves as corroborative evidence of the author's heart reflex theory of angina pectoris. Not infrequently eructations of gas attend the concussion and here it is assumed, that concussion not only provokes the heart reflex by reflex stimulation of the vagus, but also the stomach reflex of contraction (page 316).

By means of the heart reflex, one can easily comprehend the attacks of false angina. In functional angina, the heart reflex is always accentuated, as I have assured myself by repeated x-ray examinations. In cardiodynia (*Herzangst*) observed in neurotics, one is dealing essentially with a *psychic heart reflex.*

The following table will aid in the differentiation of true and false angina pectoris:

DIFFERENTIAL TABLE OF TRUE AND FALSE ANGINA PECTORIS.

TRUE ANGINA.	FALSE ANGINA.* (Neurotic Form.)
Most frequent between the ages of 40 and 50 years.	May occur at any age and even in children.
More frequent in males and the paroxysms are evoked by exertion. The attacks are rarely periodic and nocturnal.	More frequent in women and the attacks are spontaneous, periodic and nocturnal.
No other symptoms.	Associated with nervous symptoms.
Pain is agonizing with the sensation of compression by a vice.	Pain is less severe and the sensation is one of distention.
The pain is of short duration and the patient is silent and immobile.	Pain may continue for one or two hours and the patient is restless and talkative.
The lesion is a sclerosis of the coronary artery.	Neuralgia of nerves and cardio-plexus.
Prognosis grave.	Never fatal.
Arterial medication is effective. Antipyrin (large dose) may accentuate the pain, at any rate it gives no relief.	Antineuralgic medication. Antipyrin (large dose) is effective in subduing the pain (Huchard).

There are etiological factors concerned in angina which on first view could find no explanation by my *heart reflex ischemic theory*, yet, on reflection, the theory is applicable. Thus, one of my friends, a physician in Paris, suffers like several other members of his family from pronounced attacks of angina pectoris several hours after the use of coffee, tea or tobacco. One knows, for instance, that the effect of caffeine in small doses on the cardiac muscle is to increase its activity; in larger doses, it produces phenomena analogous to fatigue, and in very large doses, the muscle is thrown into

*Reference on page 194 has already been made to false angina caused by *intercostal neuralgia*.

rigor. In the latter instance, the strong contraction of the myocardium (which is essentially a heart reflex) mechanically compresses the coronary vessels.

The toxic factor here involved in eliciting the heart reflex is necessarily delayed and cannot be immediate like the other factors concerned in the elicitation of the reflex in question. Digitalis and other circulatory stimulants may provoke an attack of angina for the reason that they augment the tonicity

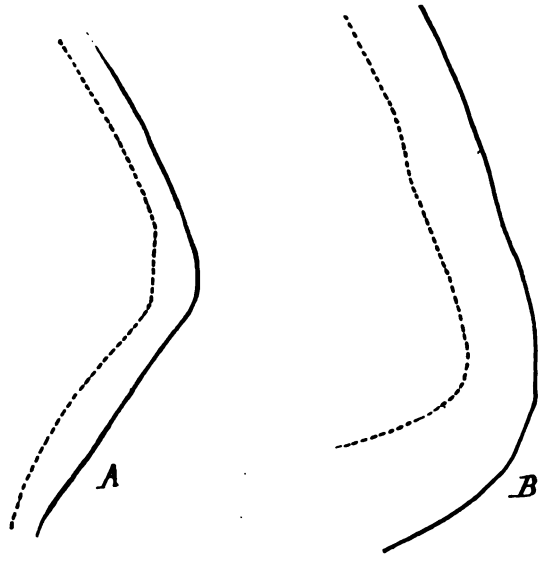


FIG. 62.—The heart reflex; A before, and B, after, the use of digitalis.

of the cardiac musculature. Digitalis increases the amplitude of the heart reflex as shown in Fig. 62.

Recently I have observed the following singular phenomenon: After placing the ankle of one lower extremity on the knee of the other extremity, the pulse of the anterior tibial artery is easily palpated (Fig. 63).

Next, direct the patient forcibly to extend and flex his foot (the leg occupying the same position) a number of

times in succession. If the tibial pulse is again sought, it will be either very feeble or absent. In the norm fully thirty seconds may elapse before the pulse has attained its former volume. The blood-pressure also falls. In a patient with claudication, five minutes elapsed before the tibial pulse resumed its former volume. This test may prove of value in the diagnosis of the latter affection. I assume that the tibial artery, immersed as it is in a muscular atmosphere, responds reflexly to the muscular contractions, and in arte-

FIG. 63.—Position of the leg to facilitate palpation of the anterior tibial artery.

riosclerosis the longer duration of the arterial contraction accounts for the phenomena of claudication. Here, as in my heart reflex theory of angina, the ischemia is dissociated with vaso-motor action, insomuch as when amyl nitrite is inhaled, obliteration of the tibial artery is effected by the muscular manœuver suggested.

The treatment of angina pectoris includes the elimination of all factors concerned in the elicitation of the heart reflex. The value of amyl nitrite inhalation in the treatment of a

paroxysm is universally conceded. When the latter drug fails, and it often does, the failure may be attributed to irritation of the nasal mucosa which induces the heart reflex, which would still further accentuate the paroxysm. In such instances and, in fact, in nearly all instances, the action of the drug in question is aided by previous cocainization of the nasal mucosa, which eliminates the irritant factor in amyl nitrite inhalations. Concussion of the lower dorsal

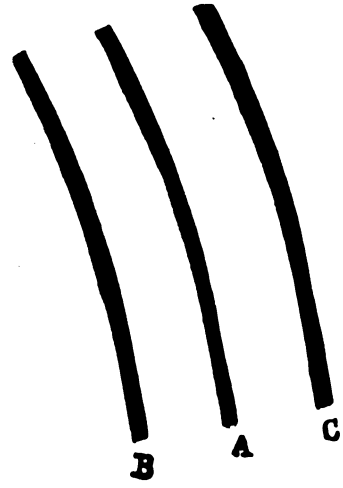


FIG. 64.—Demonstrating the amplitude of the heart reflex: C, left border of the deep cardiac dullness; A, recession of the same border when the heart reflex is elicited after excitation of the precordial region; B, still further recession of the same border when the heart reflex is elicited after concussion of the spinous process of the 7th cervical vertebra. Note in this figure that after concussion of the four lower dorsal vertebræ to excite the heart reflex of dilatation, the amplitude of the heart reflex of contraction after concussing the spinous process of the 7th cervical vertebra is from C to A only.

vertebræ (daily treatment) should be given a trial in the treatment of angina pectoris to induce the counter-reflex of dilatation.

It will be noted in Fig. 64, that after the heart reflex of dilatation is elicited, the amplitude of the heart reflex of contraction is diminished. In some instances, the treatment suggested for angina pectoris (true and false) and

cardiodynia is very effective, whereas in other instances, no results are achieved.

FUNCTIONAL AFFECTIONS OF THE HEART.

INHIBITION OF THE HEART.

The rapidity and force of cardiac action are regulated by the pneumogastric or vagus nerve, which inbibits it, and the

FIG. 65.—**Position of head to inhibit the heart.** This position is the one adopted for obtaining the vago-visceral reflexes (*q. v.*).

sympathetic, which accelerates it. Many persons can voluntarily stop the action of the heart, and among Indian sorcerers, the phenomenon is regarded as a marvelous feat. The explanation, however, is very simple: by voluntary contraction of the muscles of the neck innervated by the

nervus accessorius, the branches of the latter running in the path of the vagus nerve are irritated, resulting in temporary stoppage of the heart action. Czermak was able to press his vagus nerve against a little bony tumor in the neck, and by thus subjecting the nerve to mechanic stimulation was able to slow or even stop the beating of his own heart.

If, in almost any healthy person, the carotid artery, or a point immediately adjacent to it in the neck, is compressed, slowing or complete inhibition of the heart and pulse ensues. This phenomenon is explained by compression of the vagus lying alongside the carotid artery.

The author has shown, that forcible compression of the abdominal muscles (Fig. 59), inhalation of irritating vapors, firm pressure in any of the intercostal spaces and pressure at the vertebral exits of the spinal nerves (preferably at the side of the upper dorsal vertebræ, Fig. 48), will result in a reflex inhibition of the heart. A method which the author employs for this purpose is to have the patient firmly contract the muscles of the neck as shown in Fig. 65.

There are many functional NEUROSES OF THE HEART, such as *palpitation*, *arrhythmia* and *tachycardia*, which owe their origin to insufficiency of the vagus nerve, and in consequence of such incompetency, the mastery of the organ is assumed by the sympathetic.

Now we know that the action of the vagus can be reflexly controlled by the manœuvers already cited, and in this action, acceleration and irregularity of the heart can be mastered. By executing such a manœuver, we are merely subduing one reflex by its counter-reflex.

In a case of *tachycardia* (heart-hurry) reported by Nothnagel, the attacks were jugulated by deep inspirations, and Rosenfeld's patient controlled her attack by going to bed, raising her head with her feet planted firmly against

the foot of the couch, and then taking a forced inspiration she pressed down with all her might, with the object of closing her glottis.

A patient of mine, a neurasthenic, controlled his attacks of palpitation by firm compression of an intercostal space with his finger.

An analysis of the foregoing manœuvers, acquired instinctively, shows that what the patients did was to call into action the functions of the vagus nerve.

The spinal region in juxtaposition to the vertebral exits of the upper spinal nerves (at about the spinous process of the 4th dorsal vertebra), is the most favorable site for calling into activity the functions of the inhibitory nerve of the heart. Here the most suitable method is to make firm compression (and maintain the compression for several minutes) with the thumbs on either side of the spine.

The application of an ice-bag in the region shown in Fig. 48 (corresponding to 7th cervical spine) is often of service and the same may be said of the sinusoidal current; one electrode in the sacral region and the other electrode in the region indicated in Fig. 48. In arrhythmia, the action of this current is often surprisingly efficient.

The latter manœuver is equally available in *diagnosis*. Thus, in irregular action of the heart or in delirium cordis, the inhibition manœuver, by temporarily inhibiting the rapidity of the heart, enables us to determine the time of a murmur; the manœuver thus simulating the physiologic action of digitalis.*

*Concerning the further employment of this manœuver in diagnosis, *vide* "Diseases of the Heart," by the author, page 59.

THE BLOOD-VESSELS.

PHYSIOLOGY.

The blood-pressure is most evident in the arteries and least pronounced in the veins, whereas in the capillaries, it is intermediate between the arteries and veins. Thus the blood circulates continuously in the direction of the lowest pressure (arteries to veins).

Arterial pressure or tension is made up of four factors:

1. Ventricular pressure.
2. Peripheral resistance.
3. Elasticity of the arterial walls.
4. The volume of the circulating blood.

INNERVATION of the blood-vessels is effected through the vaso-motor nervous system, which consists of the center in the bulb, subsidiary centers in the spinal cord and vaso-motor nerves.

The latter are of two kinds: Vasoconstrictor nerves, which when stimulated cause contraction of the vessels, and vaso-dilator nerves, which dilate the vessels. The latter supply the musculature of the vessels and regulate their caliber, and their most pronounced action is on the arterioles, which contain relatively the largest amount of muscular tissue. In the norm, the arterioles are in a state of tonic contraction, and this is what constitutes the peripheral resistance which helps to maintain the blood-pressure and thus promotes the circulation of the blood. By means of the vaso-motor apparatus the amount of blood supplied to an organ is regulated. Thus, during digestion more blood must be supplied to the digestive organs, hence the arterioles of the splanchnic area are relaxed and there is a constriction of the vessels in other areas, as, for example, the skin; the chilly sensations after a meal are attributable to the latter fact. In certain

organs, like the lung and brain, there are no vaso-motor nerves, because there are no variations in the blood-supply. There are afferent impulses which may reflexly excite the vaso-motor center in the medulla, and such impulses are divided into *pressor* and *depressor*. Most sensory nerves contain pressor fibers which, when stimulated, cause a rise of blood-pressure, whereas the depressor fibers also present in many sensory nerves will, when stimulated, cause a fall of blood-pressure. A distinct nerve known as the depressor nerve exists in animals in the trunk of the vagus, or as a separate branch running from the heart or the commencement of the aorta, and reaches the vaso-motor center by joining the vagus.

PATHOLOGIC PHYSIOLOGY.

The primary factor in blood-pressure is the force of ventricular systole, and any increase in the volume-output causes a rise, and conversely a fall, in pressure, provided the peripheral resistance is the same. In animals the pulse-rate is slowed when the arterial pressure is raised and accelerated when lowered. A continued high blood-pressure entails increased work on the part of the heart, but the abnormal tension of the ventricular wall stimulates the filaments of the depressor nerve and thus automatically causes a fall of pressure. Another protective mechanism exists to prevent excessive blood-pressure, and that is, when the peripheral resistance is very much augmented, the volume-output of the ventricle diminishes. *Peripheral resistance*, as has been noted, is made up of the tonus of the arterioles, but there are minor factors also concerned, notably, friction due to the viscosity of the blood and the subdivisions of the arterial tree. It has been shown that the veins also possess tonus. Thus, stimulation of a splanchnic nerve will produce a contraction of the portal vein. The vasodilator have not

the same physiologic value as the constrictor nerves, for their division causes no narrowing of the vessel, hence they possess no tonus. It has been shown that stimulation of the muscles and the mucosa of the rectum and vagina will cause a fall of blood-pressure, and this fact is more evident during anesthesia. In the latter instance depressor in lieu of pressor reflexes occur. The abdominal vessels supplied by the splanchnic nerves have the most pronounced influence on the general blood-pressure, for the evident reason that they are sufficiently capacious to hold practically all the blood-volume of the body. *Arterial elasticity* diminishes the work of the heart. Hasebroek contends that there is a propulsive energy at the periphery independent of that in the heart, and that the periphery represents another second independent pumping apparatus, coupled with that of the heart. The periphery has not only its elastic contraction and expansion, but also its active diastole and systole in the arteries. This diastolic-systolic activity is manifested in the capillaries as a sucking-in, an inspiration, as it were, while in the arteries it is more of a propulsive energy. Both these forces combine to create an independent and forcible stream into the veins, which are passive, and merely serve as a passive reservoir for the blood-stream.

The *blood-volume* has only a subordinate influence on blood-pressure, as many experiments show. When the blood-volume is diminished, pressure is maintained by peripheral contraction of the arterioles, and when the volume is increased, certain compensatory mechanisms come into play, *viz.*, dilatation of the vessels, transudation into serous cavities and lymph-spaces, and increased activity of the secreting organs. Another important factor in compensation is dilatation of the arterioles of the abdominal viscera caused by stimulation of the depressor nerve.

NORMAL BLOOD-PRESSURE.—Pressure, like temperature and the rate of respiration, is subject to fluctuations. Most of the recorded results have been obtained with the *Riva-Rocci apparatus* and the figures quoted represent the systolic pressure. Cook and Briggs present the following as representing the average pressure:

Children up to two years	75 to 90 mm.
Children after two years	90 to 110 mm.
Young adult males, about	130 mm.
Women	10 to 15 mm. lower.

A pressure below 70 mm. signifies very low, and above 200 mm. very high tension.

Janeway has never seen a pressure above 180 mm. in a normal person, and seldom one above 160 mm. There are postural variations of pressure, hence all pressure estimations should be taken in the same position. Sleep lowers the pressure. Tobacco either increases or diminishes the pressure according to whether the subject experiences a stimulating or sedative effect; this, at least, has been my observation. Emotional influences and intellectual application increase the pressure. Muscular exertion increases the pressure, owing to augmented ventricular force; if, however, exertion is carried to exhaustion, the pressure falls.

BLOOD-PRESSURE IN DISEASE.

Among the dominant factors inducing high pressure (*hypertension*) are pains of all kinds which reflexly cause a stimulation of vaso-motor tone. Drugs like strychnin, digitalis, adrenalin, and other cardiotonics act by increasing either the peripheral resistance (vasoconstriction) or cardiac energy or both. Vasoconstriction is evoked by many toxic conditions (plumbism, nicotinism, gout, uremia). No doubt a toxic

factor is also present in many *psychoses*. During *labor pains* two factors are present, the pain and the increased volume of blood sent to the heart by compression of the abdominal vessels. In *renal affections* the cause of high pressure is due to a number of conditions, notably, cardiac hypertrophy and increased peripheral resistance due to a vaso-motor spasm provoked by the irritating action of waste-products in the blood or degeneration of the peripheral vessels or both. Hypertension necessarily increases the work of the heart unless a compensatory factor is brought into play, and the primary effect is to cause cardiac hypertrophy. A hypertrophic heart is by no means as good as a normal one, as the old dictum runs, for, sooner or later, that heart will become insufficient. Hypertension diminishes the elastic distensibility of the arterial wall, and this in turn conduces to dilatation (aneurism) and rupture (cerebral hemorrhage) of the vessels. Diminished pressure (*hypotension*) is usually regarded as such when the systolic pressure in an adult is below 100 mm. Any or all of the factors concerned in blood-pressure may be involved; wasting diseases reduce pressure by compromising all these factors. The vasodilators reduce pressure by diminishing the peripheral resistance and chloroform acts by directly paralyzing the vaso-motor center or heart. In acute infectious diseases the fall in pressure is due in part to vaso-motor paralysis and in part to weakness of the heart-muscle. Hypotension causes blood to accumulate in the veins (notably the abdominal) and diminishes the rapidity of the circulation. The vigor of the heart becomes compromised because it receives less blood.

In affections of the *nervous system* Pal found that in tabes, during the occurrence of lightning pains, the pressure fell, and that during gastric and abdominal crises there was an enormous augmentation of pressure, hence he concludes

that the latter are caused by a spasm of the splanchnic vessels. *Cerebral hemorrhage*, like all other conditions increasing intracranial tension, will cause an increase of pressure in proportion to the degree of such tension. A high and rising pressure points to more bleeding and a progressive failure of the circulation in the medulla. The observations of Bruce show that in *insomnia* there are cases with high and low pressure, and that the administration of *erythrol tetranitrate* to the former acted as a hypnotic (if it reduced tension).

In *arteriosclerosis* (which will be discussed later at great length), the pressure is usually high.

The arteries may be thickened and yet no rise of pressure exists; in fact, if the heart-muscle is weak, the pressure may even be lower than normal. Janeway concludes that high pressure in this disease indicates involvement of the small arteries, especially in the splanchnic circulation. Among the symptoms of arteriosclerosis are headache, vertigo, apoplectiform attacks, and irritability. Such symptoms are accentuated when the pressure is high, and are aggravated by raising the latter with subcutaneous injections of adrenalin and ameliorated by the use of vasodilators. Amyl nitrite inhalation may be tried to rapidly secure the latter action.

Sphygmomanometry has been utilized in tracing the etiology of *insomnia*. Thus, it is claimed that when the latter is caused by auto-intoxication, the blood-pressure is augmented, whereas it is very low in the insomnia of neurasthenia.

Marfan contends that arterial hypotension is the rule in *chronic pulmonary tuberculosis*, and that a normal or increased pressure indicates a favorable prognosis. When the tension at the commencement of the treatment is low, and is subse-

quently raised, the prognosis is equally favorable. Inversely, a constant low pressure portends an unfavorable course.

In the differential diagnosis between gouty and tuberculous affections of the skin or elsewhere, a high pressure argues in favor of the former and a low pressure in favor of the latter affection. *Albuminuria* is probably of renal origin if the pressure is high. In *neurasthenia* due to intestinal auto-intoxication the pressure is usually high, and treatment addressed to the condition will lower the pressure, whereas in neurasthenia due to actual exhaustion, the pressure is low.

In high blood-pressure due to augmented tonus of the vaso-motor center (usually present in neurasthenic conditions) the bromids carried to their physiologic effects will cause such pressure to fall. When dependent on the absorption of enterotoxins, the abdominal application of the sinusoidal current for a week (daily séances of fifteen minutes) will cause a marked reduction in blood-pressure, otherwise the influence of the current is without pronounced effect. Amyl nitrite inhalations and nitrogylcerin are transitory in their action in reducing pressure. Cook found that sodium nitrite is less transitory in its action, and that one or two grains averages a fall of from 25 to 50 mm. Hg, coming on rapidly in from five to ten minutes on an empty stomach, and its effects may last as long as four hours. Veratrum viride is more permanent in its effects for vasodilation than the other remedies mentioned.

The testimony of clinicians concerning pressure-figures in diseases of the *heart* are very conflicting, and I must therefore still adhere to my observations concerning this subject, and referred to elsewhere (page 239).

Janeway regards pressure as a means of differentiation between true and false *angina*, and observes that in the pres-

ence of a pressure above 180 mm. anginoid pain is dependent on organic disease. In chronic interstitial *nephritis* high pressure is an early and important symptom. In other renal affections the question of pressure is less important. Uremic symptoms cause a rise in pressure, and that improvement spontaneous or as a result of treatment will cause the pressure to fall. In fact, many writers claim that uremic symptoms (headache, vertigo, etc.) are the result of high pressure.

In *typhoid fever* observations to be of any value must be made daily with the sphygmomanometer, just as one makes the record of the pulse and temperature. In this disease the pressure begins to fall with the development of toxemic symptoms, and one notes that this fall is progressive. The following figures of Crile are interesting: The highest pressure in 115 cases was 138 mm.; the lowest, 74 mm.; and the average, 104 mm. The average pressure in the first week of the disease was 115 mm.; second, 106 mm.; third, 102 mm.; fourth, 96 mm.; and in the fifth week, 98 mm. A rapid fall in pressure indicates hemorrhage, whereas a progressive fall suggests enfeeblement of the vaso-motor centers. If perforation occurs, there is usually a sudden rise of pressure. The fall of pressure in this disease suggests the value of cardiotonic medication, which in most instances is of more value than the measures employed for reducing the temperature.

diseased cerebral arteries, the result of a sudden increase of pressure. Hemorrhage in an anesthetized patient causes a sudden fall of pressure followed by a rise, provided the bleeding is not severe or complicated by shock. In *collapse* and *shock* a fall of blood-pressure is one of the most positive signs, and the fall is always in proportion to their severity. According to Crile, collapse is a sudden shock, a progressive fall of pressure, and in which the vaso-motor center does not respond to stimuli. In these cases the danger exists in loss of the vaso-motor and not of the cardiac function. The use of chloroform is interdicted when shock is feared and peripheral stimuli are inhibited by "blocking" large nerves by means of cocain before their division. Bishop has directed attention to a constitutional condition of low arterial tension in children in whom no heart lesion exists. Such children suffer discomfort for lack of circulation (cold feet, depression and fainting attacks). The functional heart-tests show that the heart is not compromised. Otis, of Boston, suggests that blood-pressure should be taken as a routine measure. The average blood-pressure in *tuberculous persons* is about 126, and a fall in tension is suggestive of impending hemorrhage. This latter may be warded off by ergot. In hemorrhage when the blood-pressure for the individual is high, inhalations of amyl nitrite or nitroglycerin may be used internally; if low, ergotin is injected subcutaneously.

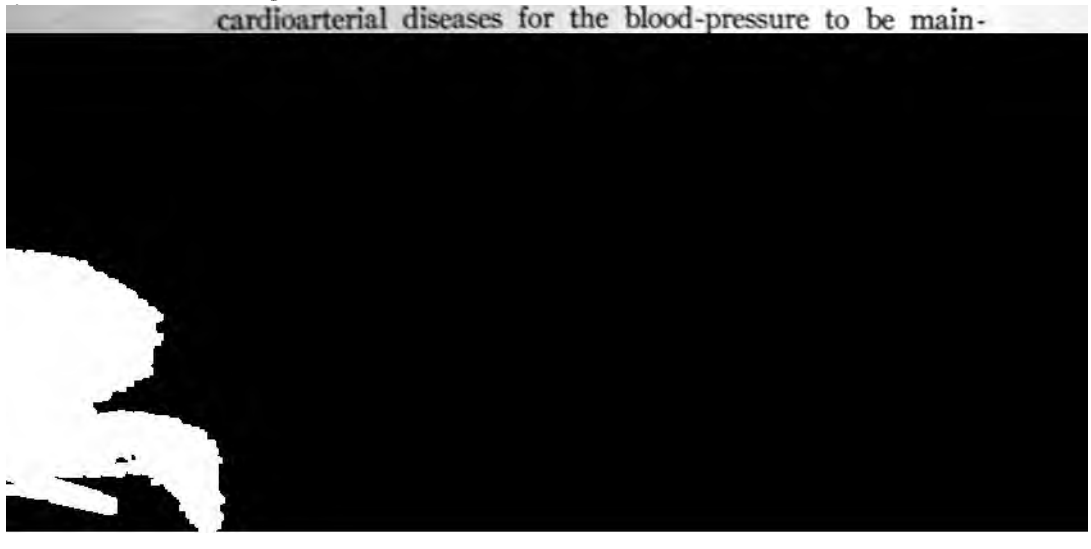
THE VASO-MOTOR FACTOR IN BLOOD-PRESSURE.

Among the factors which contribute to blood-pressure, the resistance offered by the blood-vessels is paramount.

If the vessels are dilated, the pressure falls; if contracted, it will rise. The nervous mechanism which presides over the tonus of the blood-vessels is the vaso-motor apparatus, and while the latter, I concede, may be reflexly influenced

by irritation from the blood-vessels themselves or from the end-organs of sensory nerves in general, we are inclined to forget that the vaso-motor apparatus may operate independently of such influences. Emotions, and the state of mind in general, greatly influence the caliber of the blood-vessels through the vaso-motor system of nerves. Take neurasthenics for a paradigm, and I have examined a large number of them at different periods under emotional influences, intense mental application, and when their brains were at rest, and in each instance my results varied. Emotional influences and intellectual application increased blood-pressure, while mental rest reduced it. Blood-pressure is also influenced by physical activity, ingestion of food, menstruation, etc. In other words, blood-pressure, to me, signifies nothing unless one takes into consideration the vaso-motor factor.

Concerning the vaso-motor factor, the following conclusions may be formulated: (1) Blood-pressure is an expression of action of two chief factors—ventricular force and vasoconstriction. (2) The inhalation of amyl nitrite dissipates the vasoconstrictor factor and brings into play the ventricular force, which is the real factor to be encouraged in a failing heart. (3) The vasoconstrictor factor may and does compensate ventricular inadequacy, for it is essential in most cardioarterial diseases for the blood-pressure to be main-



variation. In the erect posture blood-pressure rises, owing to compensatory arteriole contraction, and this difference between recumbency and standing varies, according to my measurements with the Riva-Rocci instrument, between 15 and 30 mm. In vaso-motor insufficiency the postural variations are reversed, and this is especially true in neurasthenia, notably, the angiopathic form, and in the form described by the author as "splanchnic neurasthenia," where the blood shows an abnormal tendency to accumulate in the splanchnic area. I regard a continuously maintained high blood-pressure as the most constant factor in the etiology of arteriosclerosis, and, further, consider that the poisons absorbed from the intestinal canal are largely responsible for such high tension. The latter factor is easy of determination.

VASO-MOTOR METHOD OF TESTING CARDIAC SUFFICIENCY.—As remarked before, blood-pressure is the resultant of two chief factors, *viz.*, force of the cardiac ventricle and vaso-constriction. Remove the latter, and the ventricular force will come into play. Blood-pressure as taken ordinarily means nothing, for it is difficult to gauge how much of it is due to the action of the vaso-motor nerves and how much to the condition of the heart-muscle. The heart may be very weak, and yet show high blood-pressure, because vasoconstriction compensates a failing heart. The method is, briefly, to take blood-pressure in the usual way; next have the patient inhale amyl nitrite from a bottle until the physiologic action (flushing) of the drug is secured, at which time again take the blood-pressure. In the norm the average increase of the pressure after the inhalation is from 6 to 10 mm. In cardiac enfeeblement there is a fall instead of a rise of pressure, and the degree of fall is proportional to the degree of myocardial insufficiency. All my investigations were

made with the Riva-Rocci instrument. Clinicians have unreservedly accepted the dictum of the physiologist that the nitrites lower the blood-pressure. The latter may be true with toxic doses, but my clinical investigations show that amyl nitrite inhalations will, in the norm, cause the pressure primarily to fall, but the systolic pressure immediately rises. It has been shown experimentally that if a nitrite is introduced into the cerebral circulation and prevented from attaining the general circulation, there is no fall in the blood-pressure.

ARTERIOSCLEROTICS, according to my clinical observations, may be classified as follows: (1) Those with high blood-pressure and strong cardiac tones who show, after amyl nitrite inhalations, a stabile or a slight rise of blood-pressure. Here the cardiac musculature is not yet compromised. (2) Those with high blood-pressure and enfeebled cardiac tones, who show after the inhalation a decided decrease of blood-pressure. In this, as well as the succeeding class, the reduction in blood-tension is influenced by the elimination of the tonus of the arteries, which was maintained by the vaso-motor system of nerves, thus allowing the true endocardial pressure, which is enfeebled, to be brought into action. (3) Those with relatively low blood-pressure and enfeebled heart tones who demonstrate a still further reduction of pressure after the inhalation. In a prognostic sense the latter class of arteriosclerotics belong to the hopeless category, insomuch as the vaso-motor system of nerves is either exhausted or unable to properly usurp the functions of a failing heart.

TEST FOR ADMINISTERING HEART TONICS.—All cardiac tonics may be divided into direct or indirect; the former acting by direct stimulation of the heart; the latter, by improving the nutrition of the organ or by relieving vessel-

tension and hastening the output of blood from the heart. I select a reliable *infusion of digitalis* for diagnostic purposes. In the therapeutic stadium—*i. e.*, after its administration for about three days—it has a dual action, slowing the pulse and augmenting blood-pressure. The latter is the product of two forces—increased heart-work and augmentation of the vessel-tone. Now, it is evident that digitalis may do as much harm as it does good. Supposing, before giving digitalis, we noted that the blood-pressure was 218 mm., and that after the inhalation of amyl nitrite it was reduced to 190 mm.; that after the use of digitalis it was 215 mm., but the amyl nitrite inhalation reduced it to 150 mm. Now, the theory of action of the drug on the patient was practically as follows: The blood-pressure was essentially the same after as before the use of digitalis, but while amyl nitrite before the use of digitalis reduced the blood-pressure only 28 mm., after its use the pressure was reduced 65 mm. This would indicate that the digitalis was unfavorable in its action, for, after the tonus of the blood-vessels was removed by amyl nitrite, the greater reduction in blood-pressure demonstrated that the cardiac force was further reduced after than before the use of digitalis. In other words, digitalis was goading a jaded heart, and the high blood-pressure was illusory.

This action is not uncommon in the administration of digitalis, owing to its vasoconstrictor influence, and when the latter implicates the coronary blood-vessels, the nutrition of the heart must suffer. In the case just mentioned digitalis showed an unfavorable action, but when it was given in combination with diuretin, which antagonizes the vaso-constrictor components of digitalis, the action of the latter drug was more favorable, the blood-pressure falling only 15 in lieu of 65 mm. Any of the nitrites may be combined with digitalis or strychnin when the vasoconstrictor effects of

the latter are undesired. *Strychnin*, like many other drugs, has been discredited as a heart tonic because clinical measurements of the blood-pressure show no rise. The fact is that the vaso-motor mechanism which supplements the cardiac vigor increases the blood tension when the latter is enfeebled, and diminishes it when the cardiac strength is not involved. After adequate doses of strychnin hypodermatically, the vaso-motor method of estimating pressure shows the cardiotonic properties of strychnin. In all instances cardiac auscultation and sphygmomanometry are necessary for estimating the action of cardiotonics. The sphygmomanometer only gauges the force of the left ventricle, and to determine the sufficiency of the right ventricle, auscultation of the cardiac tones is alone adequate. The cardiac chambers, even in health, are not constant as far as their diameters are concerned; on the contrary, they contract and dilate; in other words, their capacity tends to diminish with increasing cardiac vigor; hence percussion shows an increase or diminution in the area of cardiac dullness according to whether the heart is insufficient or sufficient.

SPHYGMOMANOMETRY.

The instrument employed for estimating blood-pressure is called a sphygmomanometer and it is as essential to the physician as is his clinical thermometer. All sphygmomanometers are based on the principal of circular compression of the arm by an arm-piece, *B* (Fig. 66.), connected with a manometer (*A*) and an inflating apparatus (*C*). When the arm-piece is sufficiently tight to obliterate the pulse at the wrist, the height of the mercury in the manometer indicates the maximum systolic pressure. With the instruments of Janeway and Stanton, the diastolic pressure

can also be obtained. The highest pressure in the pulse-wave is the systolic; the lowest, the diastolic; and mean pressure signifies the average of systolic and diastolic pressures. For all practical purposes it is sufficient to estimate the systolic pressure, for it is more often modified by pathologic conditions than the diastolic pressure. The diastolic pressure in a normal pulse is 25 to 40 mm. below

FIG. 66.—Sphygmomanometer of Riva-Rocci (Cook's modification): A, manometer; B, arm-piece; C, inflating apparatus.

the systolic pressure, and in high tension it may be as low as 50 to 80 mm. Many circumstances modify our clinical results, and certain precautions must be taken with the use of all sphygmomanometers. All observations must be made with the patient in the same position; the arm-piece should be applied at the heart-level and should fit accurately. A wide arm-piece (12 cm.) must be employed. The connections must consist of non-distensible tubing. It is, of

course, better to employ an instrument which measures systolic and diastolic pressures.

The author has frequently noted in his observations the possibility of mistaking his own pulsations for those of the patient. To obviate this error in estimating blood-pressure, he places a rubber ring at the base of his index-finger to exclude the blood, and consequently the pulse from the latter (Fig. 67).

TREATMENT OF HYPERTENSION.

The drugs employed for reducing a high blood-pressure are known as *vasodilators*. They produce paralysis of the vasoconstrictor mechanism, which is first manifested in the

FIG. 67.—Rubber-ring for excluding auto-pulsations.

face by dilatation of the cutaneous blood-vessels (blushing). The redness is not confined to the face, but may extend over the entire trunk. With the flushing there is also a sense of heat, throbbing of the blood-vessels, headache, quickening of the pulse and respiration, and ringing of the ears. The veins are likewise dilated. The dilatation of the arterioles and veins of the splanchnic area leads to a decline in the general arterial pressure. In the administration of the drugs of this class one must push them sufficiently to secure their physiologic effects, and then reduce the dose or stop the drug when the patient complains of throbbing or a feeling of fullness in the head. Some patients show a

remarkable idiosyncrasy to drugs of this class, reacting to insignificant doses, whereas others are resistant to very large doses. It is evident, then, that one must begin with small doses to test individual susceptibility.

Among the drugs used for lowering blood-pressure are the following:

1. *Amyl nitrite*, which is employed by inhalation. Its action is manifested within fifteen seconds and the symptoms disappear within three minutes.
2. *Erythrol tetranitrate* (tetranitrol). Its effects appear only after an hour and they last about five hours. Dose, one-half to two grains, usually in tablets.
3 *Nitroglycerin* (trinitrin). This drug acts in about two or three minutes, but its effects only last from one-half to three hours. It is official as a one per cent alcoholic solution; *Spiritus glycerylis nitratis*, dose, one to three minims.
4. *Sodium nitrite*, given in doses of from two to three grains. It corresponds in rapidity and duration of action to trinitrin.
5. *Potassium iodid*, although not an active vasodilator, clinical observations show that by its prolonged use, a lowering of blood-pressure may be achieved, probably in consequence of its vasodilator action.
6. High blood-pressure is often maintained as a result of augmented tonus of the vaso-motor center, and is quite independent of vascular disease. It is essentially a nervous phenomenon. Give such subjects sufficiently large doses of *bromids* for several days, and it will be noted that there is a considerable fall in the blood-pressure.

In the opinion of the author, pharmacotherapy is not always satisfactory in the treatment of hypertension for the reason that toleration for the vasodilators is rapidly acquired and for the additional reason that their action is evanescent.

From what has preceded, one is justified in concluding that, hypertension is often a condition which is desirable and not to be opposed, insomuch as the vasoconstriction may compensate a failing heart. In such instances, vaso-constrictors are injurious and the correct course to pursue is to strengthen the heart and the blood-pressure will fall of its own accord.

The latter effect may be rapidly attained by *concussion of the spinous process of the 7th cervical vertebra* or more slowly by the administration of digitalis.

The following case is cited as a paradigm of many like cases illustrating the preceding fact.

A patient has a blood-pressure of 240 mm. Auscultation and percussion of the heart demonstrate cardiac enfeeblement. Concussion of the spinous process of the 7th cervical vertebra is executed (duration of séance, 5 minutes). The blood-pressure is again taken and found to have fallen 30 mm. Each day thereafter, concussion is executed and, at the end of about ten days, the blood-pressure has fallen to 165 mm., the area of cardiac dullness is diminished and there is a decided strengthening of the heart-tones. Later, in consequence of over-exertion, an examination of the heart shows cardiac enfeeblement and the blood-pressure has risen to 200 mm., but with repetition of the concussion-treatment, the pressure falls to 165 mm.

Now, in a case like the preceding, an examination of the heart would not have been necessary to justify the conclusion, that the high blood-pressure was only an expression of cardiac enfeeblement; estimating the blood-pressure before and after the concussion-treatment would have sufficed to warrant the deduction.

Many erroneous conclusions are formulated concerning the vigor of the heart by aid of auscultation. Here, it is

assumed, that accentuation of the second aortic tone suggests vigor of the left ventricle of the heart, yet one may hear very loud heart-tones in anemic and emaciated persons. The fact is, that two factors contribute to the genesis of the tones of the heart, *viz.*, muscle and valves, and it is often difficult to distinguish the prolonged and dull sound of the former from the short and sharp sound of the latter.

CONCUSSION IN HYPERTENSION AND HYPOTENSION.

The writer has established empirically that, one may rapidly reduce the blood-pressure by applying the concussor (large enough to include two spinous processes, Fig. 50) of a vibratory apparatus yielding a forcible percussion stroke to the spines of the *2nd and 3rd dorsal vertebræ* and maintaining the séance for about five minutes. Hundreds of investigations thus made convince the author that, by this method, one is in possession of a means for reducing pressure heretofore unattainable by pharmacotherapy, insomuch as the results are more rapid and lasting. The following are the records of two arteriosclerotics:

1. Mrs. W.

Blood-Pressure before vibration of the 2nd and 3rd dorsal spines	225 mm.
One minute after vibration	218 mm.
Two minutes after vibration	185 mm.
Three minutes after vibration	178 mm.
Fifteen minutes after vibration	180 mm.
Thirty-five minutes after vibration	178 mm.
Two hours after vibration	172 mm.
The following day	168 mm.

2. Mr. S.

Blood-Pressure before vibration	228 mm.
Two minutes after vibration	232 mm.
Five minutes after vibration	210 mm.
Eighteen minutes after vibration	200 mm.

Not infrequently, the primary result of concussion is manifested by a temporary rise of pressure followed by a decided fall which attains its maximum in about two hours time. One must not assume, however, that the results in hypertension are always uniform. In some instances no effect is achieved, and the author is constrained to believe that, in such cases, the hypertension is due to cardiac enfeeblement, and it is only after toning the heart that a fall of blood-pressure occurs.

When the blood-pressure is diminished in arteriosclerotics by aid of concussion, it is usual to find a heart showing little or no enfeeblement. If there is no fall of pressure following concussion of the 2nd and 3rd dorsal spines and and a fall is only observed *after concussion of the 7th cervical spine*, the high pressure is caused by cardiac weakness and concussion of the spine in question is indicated to reduce pressure which it does by toning the heart.

If a patient has certain symptoms which one assumes are caused by the arterial hypertension, a reduction of the latter by the foregoing method (concussion of the 2nd and 3rd dorsal spines *or* 7th cervical spine) suggests the correctness of the diagnosis and the treatment conducted along the same lines will prove in a relative sense, curable.

Thus in *cerebral arteriosclerosis*, the patient may have headache, vertigo, transient pareses or aphasia. If, following concussion, there is diminished arterial-tension and an abatement of symptoms, the diagnosis is suggested.

LOW BLOOD-PRESSURE.

(Hypotension.)

A systolic pressure below 100 mm., suggests hypotension and is observed in wasting diseases, infections, hemorrhages, collapse and shock and after the use of vasodilators.

SUPRARENAL INSUFFICIENCY.—The "*tache cérébrale*" is a red line with white borders produced by drawing the nail over the skin. It is a vaso-motor phenomenon present in typhoid fever and meningitis, and is without diagnostic significance. Sergent directed attention to a "white line," which is the converse of the *tache cérébrale*. Like the latter, it is evoked by drawing the finger-nail across the abdominal skin. Within thirty to sixty seconds a white line appears, which persists from two to five minutes. Sergent found the line in Addison's disease and in a number of specific fevers, all of which were characterized by low arterial-tension. In these cases he found that the administration of suprarenal extract caused the white line and the low tension to disappear. He therefore regards this line as useful in the diagnosis of suprarenal insufficiency and in affections of the capsules. Other French writers have confirmed this observation. The white line is caused by a reflex spasm of the capillaries, and can be provoked in vasodilatation and in conditions of low vascular tension. There is much reason to question the constancy of the white line as a diagnostic symptom. Thus, de Massary failed to observe the sign in six cases of Addison's disease, even though the arterial tension was very low. Grünbaum finds that the oral administration of suprarenal extract to normal individuals does not cause a rise of blood-pressure, and that when a rise follows exhibition of the drug by the mouth, it indicates suprarenal inadequacy. In doubtful cases the blood-pressure is accurately determined, and then 3-grain doses of the extract are administered thrice daily for three days. The pressure is again estimated, and a distinct increase is very suggestive of Addison's disease, provided there is no valvular lesion of the heart. Suprarenal insufficiency should be tested whenever asthenia and pigmentation are present.

The latter are the chief symptoms of Addison's disease, but are likewise present in many other diseases. If there is no bronzing in Addison's disease the application of a mustard plaster will draw the pigment to the surface of the skin.

NEURASTHENIA is often associated with hypotension, in fact, it is the only demonstrable sign in these cases. Such patients usually complain of obscure abdominal symptoms (SPLANCHNIC NEURASTHENIA) and this is not surprising considering the fact that the loss of vaso-motor tone conduces to a large accumulation of blood in the abdominal veins.

TREATMENT OF HYPOTENSION.

It is exceedingly injudicious practice as a routine method, to have recourse to symptomatic treatment, but insomuch as physicians are human and not divine, such treatment is often imperative and indeed efficacious, when the causal factor is not demonstrable.

Thus, in hypotension, many drugs are efficient for influencing collapse and the drugs used for this purpose are the following: Strychnin, camphor, caffein, strychnin and ether.

The foregoing cardio-vascular stimulants, however, are only temporary in their action.

Much was expected of *adrenalin* in the treatment of hypotension, but, unfortunately, disappointment has attended its employment.

This agent causes a decided rise of blood-pressure, due to its vasoconstrictor action on the blood-vessels and by its direct action on the heart. It causes retardation and strengthening of the heart-beat. The vascular constriction is most pronounced in the splanchnic and muscular vessels, and feeble or absent in the cerebral and pulmonary vessels.

The renal vessels are first constricted, with diminished flow of urine, but dilate with larger doses and increased flow of urine. The augmented blood-pressure almost immediately succeeds the use of the drug, but it is of short duration. It has been found that vasoconstriction is of greater duration than the rise of blood-pressure, and this is explained by the fact that the stimulating effect on the heart is of less duration than the stimulating action of the arterial musculature.

The bath-treatment of typhoid-fever has demonstrated that, the water has a decided hypertensive action on the vaso-motor system and that it produces a rise of the blood-pressure.

The latter result demonstrates the very pertinent fact that cold water acting as a peripheral cutaneous stimulant provokes the heart reflex and, insofar as the force of the ventricular systole is the primary factor of blood-pressure, the latter rises.

Now, the author has repeatedly demonstrated that there are many individuals showing cardiac enfeeblement in whom there is no response on the part of the vaso-motor mechanism to compensate the failing heart. Hence, strengthening of the enfeebled heart by means of digitalis or by concussion of the spine of the 7th cervical vertebra results in a rise of blood-pressure.

The author has established empirically that *concussion of the spines of the 6th and 7th dorsal vertebræ* will raise the blood-pressure. The results, however, are not as uniform as is the method for reducing blood-pressure, and not infrequently, the effects are only noted after a lapse of about two hours.

If the latter method is effective, the results are relatively permanent and many neurasthenics with hypotension can bear testimony to the foregoing statement.

The duration of the séances is about the same as when concussion is employed in hypertension.

ANEURYSM OF THE THORACIC AORTA.

THE AORTIC REFLEXES.

The course of the upper surface of the normal aorta in the adult of middle life may be projected on the thorax by

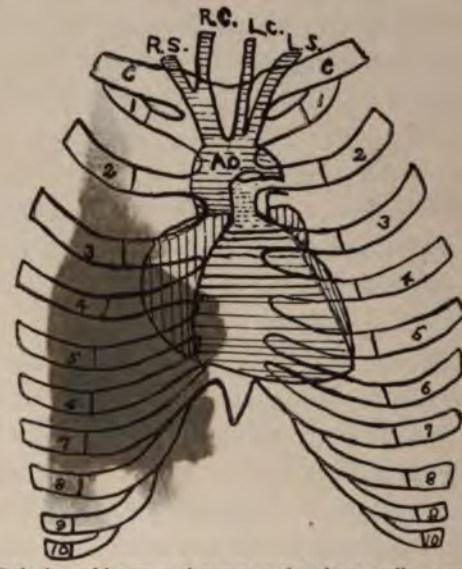


FIG. 68.—Relation of heart and aorta to the chest wall: 1-10, ribs; Ao, aorta; RS and RC, right subclavian and carotid; LS and LC, left subclavian and carotid.

drawing a curved line, beginning at a point corresponding to the right sternal line in the middle of the first intercostal space and ending at the point of insertion of the first left rib to the sternum (Fig. 68). The highest point of the aortic arch is distant about 5 cm., and the beginning 2 cm., from the anterior thoracic wall, hence a forcible percussion blow (which is propagated to a depth of 5 cm.) cannot fail to elicit the dullness of the aortic arch if dilated.

In the norm, the transverse dullness of the aorta at the level of the manubrium extends 2 or 3 cm. to the right of the median line of the sternum and 1.5 to 2.5 cm. to the left of the medial line. If the transverse dullness at this point exceeds 5 cm., the aorta is either dilated or the site of an aneurysm. The aorta is nearest the anterior chest-wall at

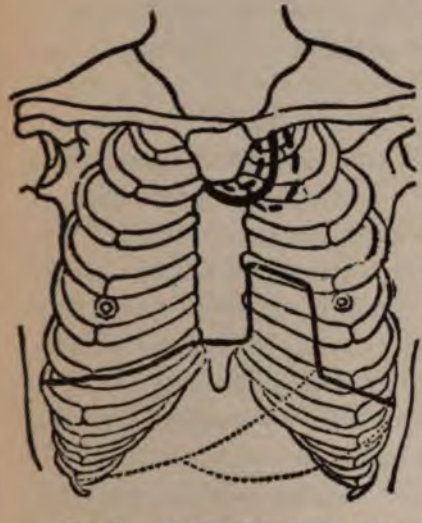


FIG. 69.—Aortic reflex of contraction and dilatation. Front.

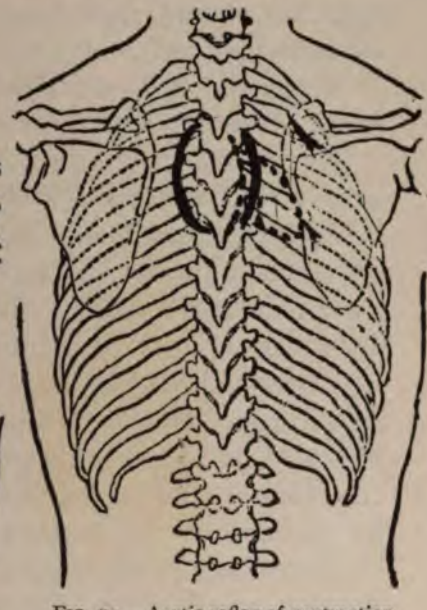


FIG. 70.—Aortic reflex of contraction and dilatation. Back.

the junction of the 2nd right interspace with the sternum. From this point as it arches over to the left, it sinks deeper into the cavity of the thorax so that it eludes percussion.

Concussion of the *four last dorsal vertebras* (9th to the 12th dorsal vertebra) in succession, by a series of sharp, vigorous blows will, in the norm, dilate the thoracic aorta which can be demonstrated by the x-rays and by percussion. Percussion must be executed at once after concussion of the vertebral spines in question, insomuch as the duration of

the *reflex of aortic dilatation* is limited (from one-half to one minute). Vibrosuppression (page 80) will aid in defining the course of the aorta.

Concussion of the spine of the *7th cervical vertebra* causes a contraction of the thoracic aorta (*aortic reflex of contraction*). Thus it is, that when one provokes the dilatation reflex, the counter reflex of contraction will, at once, dissipate the former reflex.

Percussion of the vertebral spines is executed by means of the hammer and pleximeter or the hands (Fig. 3).

THE AORTIC REFLEXES IN DIAGNOSIS.

As before remarked, one is able to define by percussion the normal area of the arch of the aorta after concussion of the four lower dorsal vertebræ. Thus it is, that if the diminished resonance or dullness exceeds the norm, either the vessel is dilated or it is the site of an aneurysm. One may remark that if an *aortitis* is present, the reflex of dilatation will reproduce the symptoms peculiar to this affection, *viz.*, pains in the upper sternal region extending through the mediastinum and to the shoulder and arm.

A dull area in the upper thoracic region or in the back (corresponding to the site of the aorta), if caused by a thoracic aneurysm, will show a diminished area of dullness when the spine of the 7th cervical vertebra is concussed (aortic reflex of contraction), and an increased area of dullness, when the spines of the four lower dorsal vertebræ are successively concussed (aortic reflex of dilatation). Up to the present time of writing, the author has examined 45 cases of aneurysm of the thoracic aorta and has noted an absence of the reflex in only two patients in whom the aneurysms had attained enormous dimensions. All these cases were controlled by skiascopic examinations. With

the latter, one may note a contraction and dilatation of the aneurysmal sac when the spines of the special vertebræ are concussed. One may generally observe an almost immediate evanescence of pressure-symptoms (dyspnea, cough and pains) when the sac is brought to contraction after a single séance of vibration-treatment applied to the spine of the 7th cervical vertebra.

THE AORTIC REFLEX OF CONTRACTION IN TREATMENT.

It occurred to the writer when he first employed the aortic reflexes in diagnosis, that if concussion of the 7th cervical vertebra would cause contraction of an aneurysmal sac, this fact would prove advantageous in the treatment of a thoracic aneurysm. The results achieved have exceeded the author's expectations. Only fourteen patients with thoracic aneurysm have thus far been treated by the author according to his method, but they were all advanced cases. Absolutely no results were achieved in one case (the aneurysm had attained an immense size and the sac ruptured). This much may be said for this treatment that the results usually follow after several séances of the concussion-treatment. The first case of aneurysm of the thoracic aorta thus treated was seen in consultation with Dr. A. J. Sanderson, of Berkeley. The following record is presented:

Treatment was commenced July 7, 1905, on which date the patient complained of violent pains in the chest and dyspnea on the slightest exertion. On August 2, 1905, the x-ray shadow of the aneurysm was denser, and the aortic reflexes could not be elicited. The latter I attribute to clot-formation in the aneurysmal sac, which inhibited whatever elasticity remained in the aortic walls. At this date aneurysmal pulsations could no longer be detected by the rays. Dullness, formerly present over the sac on the anterior chest-wall could no longer be elicited. Tracheal tugging

was barely perceptible. The thoracic pains had disappeared, and there was no longer any dyspnea on exertion. On the first of September, Dr. Sanderson stated that the only symptom which remained at the time the patient left his home was slight tracheal tugging. In all my cases the latter symptom persisted despite the disappearance of subjective symptoms.

Dr. Hubert N. Rowell, of Oakland, directed a patient (male, age 56 years) to me, who noted about four years before coming, the following symptoms: Cough, pressure in the chest, dyspnea and a sensation of suffocation when he assumed the recumbent posture. An examination demonstrated a large aneurysm of the arch of the aorta.

Just before treatment was commenced, the patient could not get more than three hours sleep at night owing to paroxysmal attacks of coughing and choking. After the first treatment he could sleep the entire night, and after two weeks' treatment consisting of daily séances (five minutes duration) by means of vibration applied to the spine of the 7th cervical vertebra, the patient was practically well and there was nothing to indicate the persistence of his original trouble beyond a slight tracheal tugging. During this brief period he gained ten pounds in weight.*

Dr. William Clark, of Alameda, made the following notes concerning a patient whom he sent to me for treatment on February 26, 1909:

> MISS G. Age 30 years; native of California.
>
> Complains of croup at night whenever she catches cold.
>
> HISTORY: Measles, whooping-cough and diphtheria; typhoid fever thirteen years ago. Is not sure about scarlet fever. Menstrual history normal. About

*This patient, re-examined after a year, is absolutely well and shows an increase in weight of twenty pounds.

eight years ago noticed a choking sensation. This becoming worse, was the reason for consultation. She cannot lie on left side at night; also is quite short of breath upon exertion.

EXAMINATION: Fairly developed; *eyes protruding;* no trouble since using glasses; no headaches; has no pain. Notices that voice is more husky since I last saw her. Is slightly dyspneic at this time. Veins on the anterior part of the chest quite dilated. No pulsation over upper part of chest noticed. Examination of lungs negative. Spleen not palpable. An area of slight dullness over upper part of sternum and to the right. Loud bruit over the arch of the aorta, heard loudest at junction of the clavicle with the sternum on the left side; bruit transmitted to the subclavian and carotids, more so to the left; is also transmitted along the course of the aorta, and is heard over the abdominal aorta; also heard posteriorly over the entire course of the aorta. Radial arteries apparently not atheromatous. With laryngoscope, right vocal cord apparently not as active as the left. This, however, may be erroneous, as there is considerable difficulty in obtaining a clear view, owing to position and contour of epiglottis. No tracheal tugging detected. Left radial-pulse possibly more forcible than right. With x-ray, pronounced pulsation of the arch of the aorta noticed, and arch also noticeably elongated in a vertical line. Heart apparently not much enlarged.

DIAGNOSIS: Aneurysm or dilatation of the aortic arch.

This patient was examined by the author in association with Dr. Clark and the percussional results elicited by inducing the aortic reflexes of contraction and dilatation are noted in Fig. 71.

It was noted that, when the aortic reflex of dilatation was provoked, there was a temporary aggravation of the dyspnea

and spasmodic cough, but they were at once subdued when the aorta reflex of contraction was elicited. Within several days after treatment was commenced, all the subjective symptoms disappeared and after five weeks' treatment by percussion-massage of the spine of the 7th cervical vertebra the patient was practically discharged. The patient's

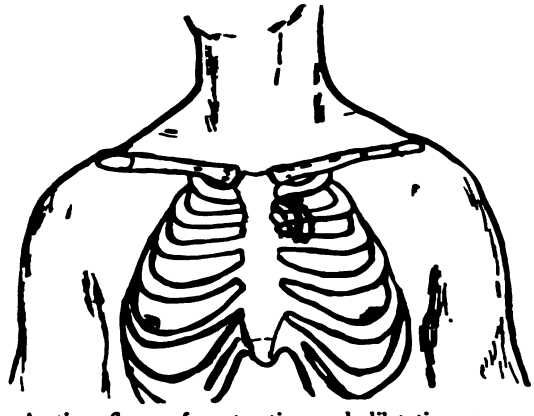
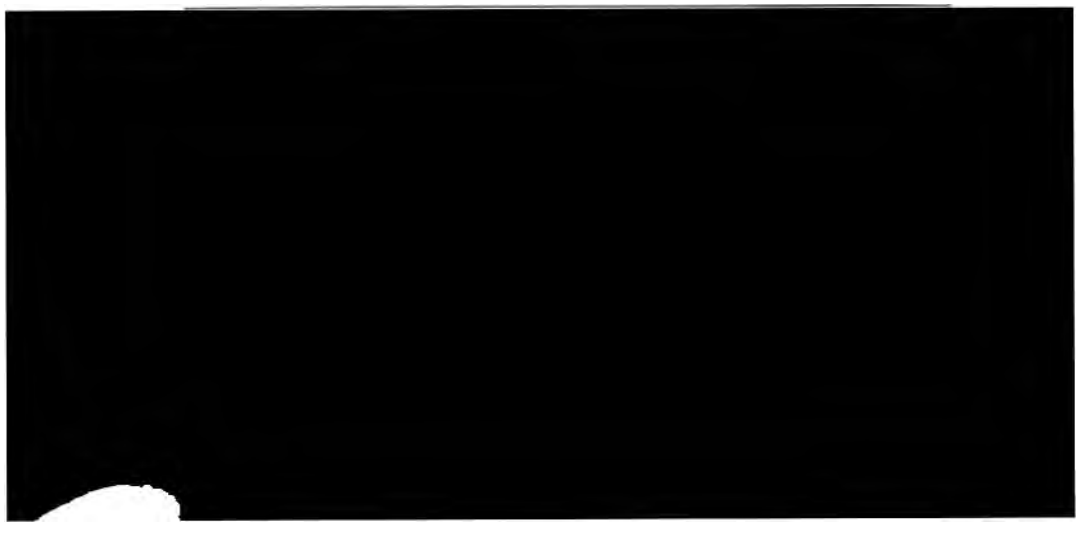


FIG. 71.—Aortic reflexes of contraction and dilatation represented by the dotted lines within and without the continuous line (which represented the area of aneurysmal dullness before elicitation of the aortic reflexes).

exophthalmos disappeared after a few treatments and further reference to this subject is made on page 280.

It is unnecessary to detail the histories of the other cases of thoracic aneurysm beyond saying that the results achieved corresponded in the main to the cases cited.*



Now, a few words are necessary respecting the method of treatment. In the therapeutic elicitation of the vertebral reflexes, notably, the aortic reflexes, the vibratory apparatus which the physician must employ is one giving the percussion stroke. All other motions, such as oscillations, shaking, and friction interfere with results; in other words, *one must select an apparatus which percusses.* First, dust some talcum powder over the site of the spine of the 7th cervical vertebra to avoid irritation from any friction of the pad connected with the apparatus; next, cover the spine of the vertebra with several layers of lint which are attached to the skin by adhesive plaster. After this, the percussion stroke may be communicated directly to the spine of the 7th cervical vertebra, or indirectly, if the skin is sensitive by interposing a strip of linoleum. The daily séances according to results, may last from five to fifteen minutes, but during the séance the treatment must be interrupted from time to time to avoid irritation of the skin. The latter may be avoided if the operator directs the patient to inform nim the moment a burning sensation is experienced.

The author only employs the pneumatic hammer (Fig. 50) for concussion and, insomuch as there is no friction, the preceding precautions are unnecessary to avoid irritation of the skin.

In the absence of a suitable apparatus one may employ a pleximeter (a strip of linoleum) applied to the 7th cervical spine which is struck a series of rapid and moderate blows by means of a hammer to the end of which is fixed a large piece of hard rubber. It is wise in this method, to protect the spinous process with a thick layer of lint.

The author has not the hardihood to regard his method of treatment of aneurysm of the thoracic aorta as curative, for time alone is the decisive factor; yet a conservative

estimate of the results thus far achieved prompts him to say that as a palliative method, it surpasses any which has yet been recommended to the profession.

The *diagnosis* of aneurysm of the thoracic aorta, despite our physical methods of examination, is often fraught with difficulty, but the latter is minimized if the physician will remember the following facts: Symptoms suggestive of an aneurysm of the thoracic or abdominal aorta are accentuated after concussion of the spines of the four lower dorsal vertebræ and they are mitigated after concussion of the spine of the 7th cervical vertebra, although several séances may be necessary to note the latter result.

Further, an area of percussional dullness which enlarges when the four lower dorsal vertebræ are concussed and diminishes when the spine of the 7th cervical vertebra is concussed, suggests an aneurysm.

It is reasonable to assume that an aneurysm of the abdominal aorta would be similarly influenced by the manœuvers suggested, but the author is in the possession of no evidence to permit him to cite a supposition as a fact.

ANEURYSM OF THE ABDOMINAL AORTA.

Since the foregoing was written, a patient was referred to me by Dr. E. N. Torello. The patient in question (male, age 65) had excruciating pains referred to the abdomen and thorax for nearly a year, which resisted all methods of treatment and necessitated the constant use of analgesics. An examination revealed signs of arteriosclerosis and a dullness in the left lumbar region; *the area of dullness increased when the four lower dorsal spines were concussed and diminished when the 7th cervical spine was concussed* (Fig. 72).

Beyond the latter, nothing was demonstrated, although

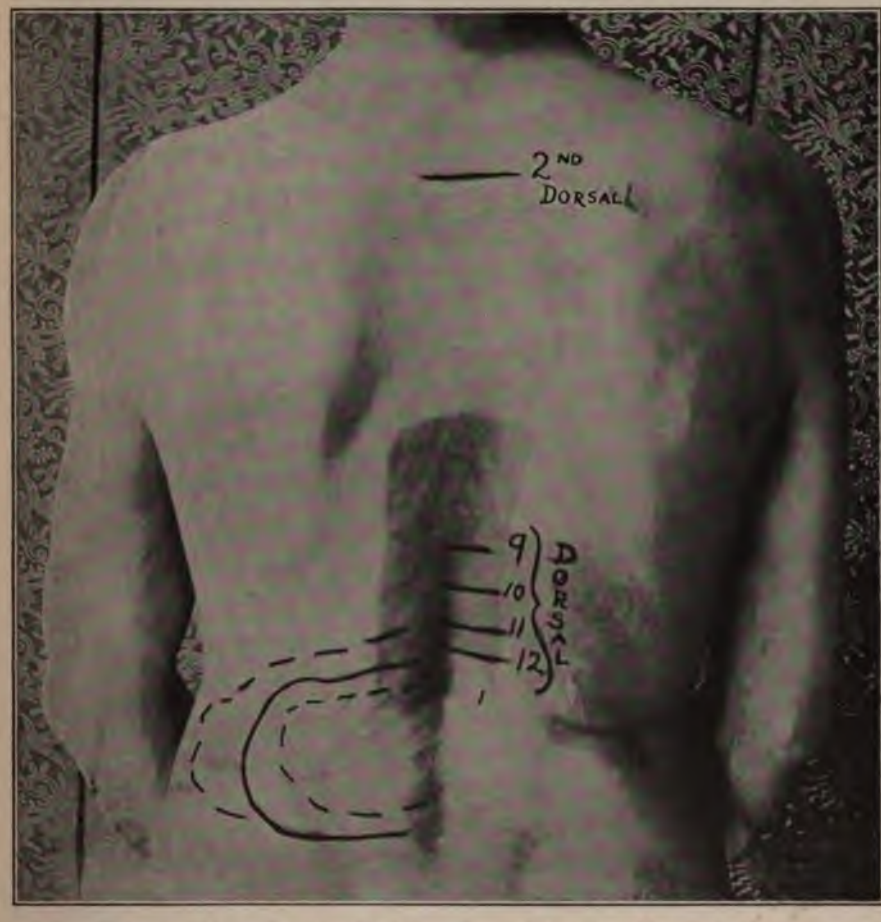


FIG. 72.—Area of dullness in aneurysm of the abdominal aorta. The continuous line represents the area of dullness before concussion, whereas the dotted line within the latter, is the aortic reflex of contraction (concussion of the 7th cervical spine), and the dotted line without, the aortic reflex of dilatation (concussion of the spines of the four lower dorsal vertebræ). It is interesting to observe that the percussion-sign in question was the only evidence suggesting an aneurysm and the diagnosis was established later by other signs.

the latter sign suggested an aneurysm of the abdominal aorta. Some weeks later the author again examined the patient with Dr. H. Sawyer, and a definite tumor could be felt with an expansile pulsation and a slight thrill. The diagnosis having been definitely established, treatment consisting of concussion of the spine of the 7th cervical vertebra was commenced; the daily séances lasting about ten minutes. After the fourth treatment the pains continued with the same intensity (night and day) as before, but the pains were strictly localized on the left side of the abdomen. Until about the tenth séance, the patient asserted that the pains were not mitigated. The latter statement was discouraging considering the fact that in the author's experience, the symptoms of thoracic aneurysm had usually yielded to a few treatments. After the tenth séance, however, the pains gradually became less intense and analgesics were no longer required.

There was later, however, a decided interruption in the improvement of the patient owing to the fact that one morning, after considerable straining at stool, the pains recurred with almost the same violence as before, but a continuation of the treatment by concussion caused the pains to disappear gradually, and at the time of writing, the patient is practically well. It may also be noted, that coincident with the recurrence of pain after straining at stool, the dullness in the left lumbar region was demonstrable. Straining at stool increases intra-abdominal pressure and rupture of an aneurysm is very likely to occur.

The author wishes to emphasize that in all his aneurysmal patients, *concussion was the only method of treatment employed*. Considering the results attained in aneurysms of the aorta, it is not beyond the domain of reason to hope for like results in aneurysms of other vessels.

REFLEX OF THE ABDOMINAL AORTA.

The 12th dorsal spine corresponds to the aortic orifice in the diaphragm and also to the celiac axis. It is known that the most frequent site of an aneurysm of the abdominal

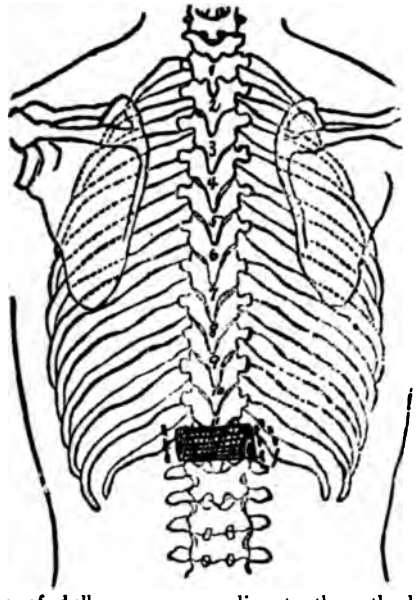


FIG. 73.—Area of dullness corresponding to the 12th dorsal vertebra and representing the reflex of the abdominal aorta after concussion the four lower dorsal spines with the hammer and pleximeter (Fig. 2). The increased area of the dullness represented by the dotted lines on both sides suggests a dilatation of the aorta, whereas the irregular dotted line on one side suggests an aneurysm.

aorta is just below the diaphragm in the neighborhood of the celiac axis. In the norm, the area over the 12th dorsal vertebra and to either side yields a resonance on percussion. If one strikes in succession the four lower dorsal spines, the normal resonance over the 12th dorsal vertebra and to either side yields a dullness which in the average subject measures about 5 cm. (Fig. 73).

If the lumbar vertebræ show resonance on percussion

prior to the elicitation of the aortic reflex of dilatation, a dullness is likewise noted over the four first vertebræ in question.

The dullness over and to the right and left of the 12th dorsal vertebra is caused by distension of the aorta. It persists for several minutes or may be dissipated at once by evoking the counter aortic reflex of contraction (concussion of the 7th cervical spine). Vibrosuppression (*q. v.*) will accentuate the dullness. If the dullness at the 12th dorsal vertebra exceeds 6 cm. in diameter, one may conclude the existence of a dilated aorta and, if the dullness is irregular, an aneurysm of this vessel may be suspected.

Since the author has elaborated the reflex of the abdominal aorta, he has recognized several cases of abdominal arteriosclerosis (by the augmented area of dullness) and by concussion of the 7th cervical spine, he has successfully treated the cases in question.*

In this connection the author wishes to refer to the valuable observation of Buch. According to the latter, arterio-sclerotic abdominal colic is specially amenable to theobromin (1.5 to 2 gm. a day), diuretin (3 to 4 gm. a day) or tinct. strophanthi (5 to 8 drops three times a day). No other form of abdominal colic is thus relieved.

PHYSIOLOGY OF THE AORTIC REFLEXES.

Claude Bernard's interesting observations advanced the clinical study of vaso-motor phenomena. He found that when the sympathetics in the neck of a rabbit were cut,

*Thus in one patient, the disease presented the picture of a *mucous colitis*. The abdominal aorta (elicted by the reflex) measured 8½ cm. at the 12th dorsal vertebra. The attacks had resisted treatment for a year, yet three séances of concussion of the 7th cervical vertebral spine, sufficed to ameliorate the attacks and they were later inhibited by further treatment. Concussion in augmenting the contractility of the dilated aorta merely contributed to the value of this vessel as a peripheral pump, thus yielding a better supply of blood.

the blood-vessels in the ear on the corresponding side became dilated and that if the peripheral ends were stimulated, the ear became blanched. Those who are adepts in manual therapy find that manual pressure along the vertebral column will evoke either vasoconstriction or vasodilation; the former by brief and the latter by continuous pressure. It is evident that in explaining the genesis of the aortic reflex of contraction, one is concerned with stimulation of the vasoconstrictor nerves, the centers of which are chiefly in the medulla, where they pass into the cord and emerge with the anterior roots as preganglionic sympathetic fibers. These fibers are not only capable of altering the caliber of the vessel, but by means of continuous stimuli passing over them, they maintain the tone of the vessels.

The aortic reflex of dilatation is associated with stimulation of the vasodilator nerves, the reflex centers of which are located in the medulla and throughout the spinal cord. From the latter situation, they emerge with the posterior spinal nerves. The author seeks to explain the aortic reflexes by either stimulation of definite vasoconstrictor and vasodilator nerves or their centers in the cord, and he has established empirically that concussion of the 7th cervical vertebra stimulates the aortic constrictor nerves, whereas the dilator nerves are excited by concussion of the spines of the four lower dorsal vertebræ.

THE PSYCHOLOGY OF CLINICAL OBSERVATIONS.

When the author published his original communication[58] on the subject of the aortic reflexes, he was the recipient of many letters, the burden of which represented the inability of the correspondents to confirm the observations of the author. It was impossible to answer all the communications at that time and, as this is an opportune moment, I will

now endeavor to answer some of them. One of the most eminent physiologists in this country protested that considering the pathologic condition of the walls of the aorta in aneurysm of that vessel, it could not in consequence be excited reflexly to alternate contraction and dilatation. Again, such clinical observations could not be accepted unless corroborated by physiologic investigations. No one can gainsay the fact that pulsation is an important sign of an aneurysm, and insomuch as this phenomenon is dependent on the elastic recoil of the walls, it follows, that elasticity of the vessel is not annihilated in aneurysm of the vessel. It is true, as the author has frequently observed, that the walls of the aneurysm do not contract nor dilate equally in eliciting the aortic reflexes; in fact, there may be no perceptible change under the influence of the reflexes at one point, but a decided change at another point, although in every instance some perceptible change was observed. Theoretically, at least, the aortic reflex will persist as long as the aneurysm pulsates.

It is now many years since Langenbeck employed ergot hypodermatically in the treatment of aortic aneurysms. He argued, that this drug by stimulating muscular tissue produced vasoconstriction and in this action the cure of an aneurysm could be effected. A storm of protest was engendered by this suggestion, his opponents declaring that the middle coat of the aorta did not contain sufficient muscular tissue to enable it to contract.

Theoretically, one would suppose that because the aorta is almost entirely composed of fibrous tissue, it is not likely to possess any contractile power, but it has such a power, nevertheless. In the case of a criminal executed at Würzburg, it was found to contract by aid of electricity immediately after death.[59]

Even though the physiologist denies that the aorta possesses contractility he must be equally consistent and deny the evidence of the x-rays, which prove that the pathologic as well as the physiologic aorta shows contractility. Until the advent of the x-rays we accepted the statement of the physiologist that the diaphragm flattened with each inspiration, but the rays demonstrated that its curve is always maintained unaltered, and in its excursions it plunges piston-wise up and down. Physiologists have always taught that the central tendon of the diaphragm is capable of only limited movement in respiration, hence the respiratory mobility of the heart is likewise restricted. The rays, however, disproved the fallacy of this contention as well as many others which space will not permit us to cite.

The clinician no longer regards the pronunciamento of the physiologist as apodictic. We have learned to discredit many statements emanating from the laboratory-investigator, not so much because the observations of the latter are faulty, but because there is a considerable difference between a laboratory and the bedside and a guinea-pig and patient. Many of the facts derived from the laboratory suggest the comment of the mathematician who, having demonstrated a new mathematical theory, thanked God that it could not be of the slightest utility to any living soul. Neither the pathologist nor the physiologist should forget that, "Pathology is the physiology of the sick." The presence of bronchodilator as well as bronchoconstrictor fibers in the vagus was conclusively established by the physiologic investigations of Dixon and Brodie in 1903, yet the author demonstrated seven years before by a simple *clinical observation* that the vagus must contain bronchodilator as well as bronchoconstrictor fibers.[69]

The final court of decree of the clinician is neither the

physiologic nor pathologic laboratory. To test a given function one must compare it with a like function in individuals of the same species. Thus, if the same quantity of uric acid were excreted in a mammal as is excreted in a normal bird, it would have to be regarded as pathologic. If disease were wholly a question of demonstrable lesions then the pathologist would be compelled to deny the existence of the so-called functional diseases. In consequence of this conflict between the laboratory and clinical investigator, a hiatus has arisen which is now occupied by clinical pathology, a branch which endeavors to conciliate scientific and empirical medicine. Several years ago, the writer observed that one could make the record of the pulsations of the head and, furthermore, that the cephalograms thus obtained in certain subjects were pathognomonic of cerebral arteriosclerosis. Investigating this subject further in the physiological laboratory of the University Hospital, London, and in Paris, the writer did not obtain the slightest clue to the cephalic pulsations and he questions, whether he is justified in rejecting a clinical observation which does not permit of physiologic demonstration in animals. One vituperator condemned my method of treating aneurysms as absurd, because it was not responsive to reason. My vituperator recalled the erudite German professor of economics who received a bed as a present. Until the small hours of the morning he busied himself with abstruse calculations to determine whether he was large enough for the bed or if the latter were large enough for him. Finally, he was struck with the happy idea of getting into the bed, and to his intense delight discovered that it was admirably suited to his proportions. If my detractor were endowed with the true scientific spirit, he would not have condemned a new method of treatment without a trial, considering the kaleidoscopic

changes constantly arising in all branches of science The scientist rejoices one day at the birth of a new theory and officiates at its burial on the morrow. In 1903, in several issues of "*The London Lancet*," a discursive polemic was agitated on the subject of my "lung reflex." It was quite evident that one of the disputants did not rigorously execute the method for eliciting the reflex in question but failed to cite this reason for condemning it, although others employed the reflex as a clinical sign of value. Many new methods for a like reason have been relegated to oblivion. Some time ago, while in Paris, the writer found several clinicians who elicited the heart reflex as a routine method of examination and appeared quite content with the sign. The writer demonstrated that the sign as elicited was of no value, insomuch as when the precordial region was stimulated, it likewise evoked the lung reflex which also diminished the area of cardiac dullness, and that, in consequence, one could only rely on the deep area of cardiac dullness as an index of myocardial retraction. A prominent Eastern clinician spent several days at the author's office investigating visceral reflexes. One of the patients submitted had an aneurysm of the thoracic aorta. Here the aortic reflexes were the object of study. It was impossible to convince the clinician that there was any modification of the area of dullness after the elicitation of the reflexes, until the writer compelled him to close his eyes while percussing, when the results of percussion tallied.

The author regrets the necessity of obtruding his personality in the discussion of this subject, but considering the theoretic objections to his method of treatment, he feels that any merit attached to it may be obscured by its simplicity.

THE VASO-MOTOR APPARATUS.†

The muscular walls of the blood-vessels (arteries, veins* and capillaries) are under the control of the vaso-constrictor and vasodilator nerves. The latter act chiefly on the walls of the small arteries (arterioles). If the vaso-constrictor nerves are stimulated, the arterioles contract and, in consequence, the resistance to the flow of blood is augmented, the pressure in the arteries rises and the capillary and venous pressures fall. A contrary effect is produced on stimulation of the vasodilator nerves. The nervous mechanism presiding over *vascular tone* concerns itself with the following:

1. Ganglia of the blood-vessels; example: pallor from cold and hyperemia from heat.
2. Anomalies of the sympathetic ganglia; example: facial hyperemia in lesions of the cervical ganglia.
3. Reflex action through the spinal cord; example: pallor from pain.
4. Reflex action through the medulla oblongata; example: glycosuria subsequent to sciatica.
5. Impulses from the cortex of the brain; example: blushing.

The *splanchnic area*‡ is most abundantly supplied with vaso-motor nerves and it is this region which is specially concerned in the distribution of blood and the general blood-pressure.

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*Mall has shown that stimulation of the splanchnics will cause contraction of the portal system and thus send twenty-seven per cent of the total quantity of blood in an animal into the right heart.

†This subject is further discussed on page 278.

‡The splanchnic area includes the vessels supplied to the intestinal tract, liver, kidneys and spleen.

Vaso-Motor Apparatus

In the norm, by aid of the regulatory mechanism of the vaso-motor nerves, each part of the body receives an amount of blood necessary for its activity and the greater the latter, the more blood it will receive in consequence of vasodilation. Simultaneously, the vessels in other parts of the body are contracted, and it is by this vascular reciprocity between

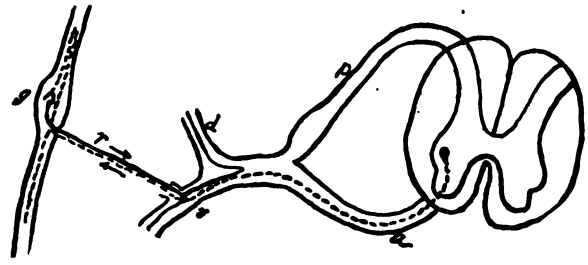


FIG. 74.—Illustrating the path of a vasoconstrictor nerve; A, anterior root, showing the course of the preganglionic fiber as a dotted line; D.V., dorsal and ventral branches of the spinal nerve; R, ramus communicans; G, sympathetic ganglion. The postganglionic fibers in each ramus come from the sympathetic ganglion with which it is connected. The preganglionic fibers entering at any ganglion may pass up or down to end in the cells of some other ganglion (Howell).

the different regions, that the normal blood-pressure is maintained.

Vasoconstrictor or dilator effects may be produced at the periphery by means of *vaso-motor reflexes*. Thus, if the right hand is immersed in cold water, the temperature falls in the left hand, and one also observes the red cheek on the implicated side in pneumonia. The vaso-motor reflex consists of sensory impulses which enter the spinal cord with the posterior nerve-roots and by irritating the centers in the cord excite constrictor or dilator effects. The cells of the vesicular columns of Clarke are supposed to be the seat of the reflexes in question.

THE VASOCONSTRICTOR NERVES.

The vasoconstrictor nerves which supply the skin, trunk and extremities, emerge from the ganglion (Fig. 74) to the corresponding spinal nerve by way of the gray ramus, and, after attaining the spinal nerve, they accompany it to its corresponding region.

The chief center for the vasoconstrictor nerves is in the medulla, but throughout the entire length of the spinal cord (excepting the cervical region and lowest part of the lumbar region), there are subsidiary centers.

The majority of the vasoconstrictor nerves emerge from the central nervous system in the anterior nerve-roots.

The following table shows the location of the vasoconstrictor neural cells in the segments of the cord:

DISTRIBUTION.	ORIGIN.
Brain, face, scalp, mucosa of the nose, mouth, salivary glands, ear and eye.	2nd, 3rd and 4th dorsal segments.
Esophagus and stomach.	4th to the 9th dorsal segments.
Small intestines.	6th dorsal to the 2nd lumbar.
Liver.	6th dorsal to the 1st lumbar (chiefly in the 10th, 11th and 12th dorsal).
Pancreas, spleen and suprarenals.	8th to the 12th dorsal.
Large intestines.	11th dorsal to the 2nd lumbar.
Bladder, uterus, external organs of generation, ovaries, testicles and prostate gland.	11th dorsal to the 2nd lumbar segments.

THE VASODILATOR NERVES.

These nerves are characterized as follows:

1. The latent period for their stimulation is longer than that of the constrictors.

2. It takes a longer time to attain the maximum effects on the dilators than it does on the constrictors.
3. The after-effect is longer.
4. The vasodilators, unlike the vasoconstrictors, are not in tonic activity and they appear in activity only during the functional activity of an organ as in the case of the erectile tissue of the penis.

The vasodilator neural cells supplying the blood-vessels of the head, scalp, face, eye and mouth are chiefly located in the nuclei of the cranial nerves. The vasodilator cells for the abdominal organs are found in the nucleus of the 10th cranial nerve and for the pelvic organs and the testicles in the 3rd, 4th and 5th sacral segments of the cord. Vaso-constrictor and vasodilator cells for the nutrient blood-vessels of the lungs and bronchial tubes (bronchial arteries), have been located with a degree of certainty in the 3rd to the 7th dorsal segments of the cord.

PATHOLOGY OF THE VASO-MOTOR NERVES.

(VASO-MOTOR NEUROSES.)

A vasomotor neurosis is expressed either as a spasm of the vessels (angiospasm) or less often as a paralysis (angio-paralysis).

ANGIOSPASM is characterized by pallor, coldness and trophic disturbances. If the spasm affects the superficial vessels, the following symptoms occur: sensory disturbances (tingling, anesthesia and analgesia) and *cutis anserina* (goose-skin). When the spasm involves larger vessels, one observes the condition known as *intermittent claudication*, in which the patient in walking suddenly loses the power in his legs.

Cases of temporary aphasia, numbness and paralyses are provoked by a like angiospasm of the cerebral vessels.

The veins may likewise be implicated in a spasm and the blood, not being able to escape from the capillaries, the parts become blue and edematous, nutrition is impaired and gangrene may ensue.

ANGIOPARALYSIS may be caused either by diminished function of the vasoconstrictor nerves or by excessive action of the vasodilators. The symptoms are similar to those observed in spasm of the veins (*vide supra*). In the condition known as *causalgia*, the blue, cold and edematous part is associated with severe pains of a burning character.

In the condition known as *erythromelalgia*, pain, tenderness and congestion of the soles of the feet are associated with a burning pain not unlike that produced by a blister. The vaso-motor phenomena occur paroxysmally and are resistant to treatment.

Another vaso-motor neurosis is the so-called *angioneurotic edema*, in which there is a sudden swelling of some part (face, neck, larynx or an extremity).

Loss of vascular tone is observed in neurasthenia, hysteria and at the menopause; there are sudden flushes or pallor.

Individuals with a "poor circulation" have cold hands or feet or the face is constantly congested.

We have also the less understood *visceral angioneuroses* characterized by hyperemia, transudations and ecchymoses.

There is an old Latin aphorism, "*Naturam morborum curationes ostendunt*" (cure shows the nature of diseases). In this sense, the pathology of many diseases is revealed by the results of treatment. In accordance with the preceding aphorism, the author contends that, there are many diseases regarded as distinct affections which are merely symptomatic of a fundamental condition, *viz.*, instability of the nervous mechanism which controls local vascular tone. This faulty mechanism, which the author is pleased to call *angio-ataxia*,

has already been referred to on page 275. It is reasonable to assume that the chief dereliction of action of this mechanism is resident in the vaso-motor centers of the spinal cord.

The author submits the following classification of angioneuroses based on the results of treatment:

ANGIOSPASM.

Symptoms: no vaso-motor reflex on irritation, skin shrunken or thrown into folds, arrested metabolism and function due to insufficient blood-supply and sensory disturbances (numbness, tingling, anesthesia and analgesia).

ANGIOSPASTIC AFFECTIONS. 1, intermittent claudication; 2, temporary paroxysms of paralysis, aphasia or hemianopsia due to spasm of the cerebral vessels; 3, reflex spasm of the vessels of the leg in *sciatica*. Nothnagel has reported five cases of the latter affection which eventuated in partial paralysis, sensory disturbances and atrophy; 4, Raynaud's disease; 5, migraine; 6, akroparesthesia.

ANGIOPARALYSIS.

Symptoms: red or mottled appearance of the skin, subjective sensation of heat, sensory disturbances (hyperesthesia and hyperalgesia), notably, a burning sensation (causalgia). The primary symptoms of redness and heat are usually succeeded by blueness, cold and impaired nutrition. The *taches cérébrales* of Trousseau, formerly regarded as pathognomonic of meningitis, is essentially an angioparalysis indicating enfeebled vasoconstrictor action. The sign is elicited by slight irritation of the skin with the finger-tip or a pencil; a white line appears followed by a bright red discoloration which persists for several minutes. *Dermatographism* is closely related to the foregoing sign: wheals in lieu of a white spot or line appear after cutaneous irritation.

ANGIOPARALYTIC AFFECTIONS: 1, erythromelalgia; 2, acrodynia; 3, aneurysm; 4, exophthalmic goitre; 5, diabetes; 6, coryza; 7, cold extremities; 8, angioparalytic symptoms of the neuroses; 9, certain toxic conditions.

Some of the foregoing conditions will be described more fully under treatment of the vaso-motor neuroses.

TREATMENT OF THE VASO-MOTOR NEUROSES.

The author presents the following table of the vaso-motor nerves in relation to the spinous processes, the object being to stimulate clinical observations in the treatment of the vaso-motor neuroses which is conceded to be a difficult matter:

ORIGIN OF THE VASOCONSTRICTOR NERVES.

AREA SUPPLIED.	DERIVATION.	RELATION TO SPINOUS PROCESSES.
Head.	First three dorsal nerves.	6th and 7th *cervical* spines.
Arm.	Seven upper dorsal nerves.	6th *cervical* spine to the 4th *dorsal* spine.
Leg.	Five lower dorsal and first lumbar nerves.	5th to the 9th *dorsal* spine.
Abdominal Viscera.	Splanchnic nerves which are made up of fibers from the 5th to the 12th dorsal nerves inclusive.	2nd to the 8th *dorsal* spine.

ORIGIN OF THE VASODILATOR NERVES.

AREA SUPPLIED.	DERIVATION.	RELATION TO SPINOUS PROCESSES.
Buccofacial region.	2nd to 5th dorsal nerves.	6th *cervical* to the 2nd *dorsal* spine.
Eye, head and ear.	8th cervical and 1st dorsal nerves.	6th *cervical* spine.
Arm.	Five upper dorsal and last cervical nerves.	5th *cervical* to 2nd *dorsal* spine.
Leg.	6th to the 12th dorsal nerves, inclusive.	3rd to the 8th *dorsal* spine.

In the experience of the author the foregoing table is of slight value in treatment with relation to the vasoconstrictors of the head, arm and abdominal viscera (page 349), but it

serves of no value in influencing the vasodilators in treatment.

In eliciting the aortic reflexes (page 254), *vasoconstriction of the aorta is best attained by concussion of the 7th cervical spine and vasodilation, by concussion of the spines of the four lower dorsal vertebræ.*

The author has found that the same rule holds good for practically all the vessels of the body, and this fact simplifies the treatment of the vaso-motor neuroses. Of all the methods investigated by the author for influencing the vaso-motor centers in the spinal cord, no method is comparable to that of concussion; in fact, it is the only method. Even in the norm, if concussion is executed over the 7th cervical spine, usually within a minute, vasoconstriction as evidenced by some pallor is noted in the hands, face and feet, whereas concussion of the four lower dorsal spines overcomes the constriction and redness and even congestion substitutes the pallor. These effects are more conspicuous when there is a diminished function of either the constrictors or dilators. Naturally, the conspicuity of pallor or redness is merely relative, and one must look sharply for the change.

The author has treated a very large number of patients with vaso-motor instability (angio-ataxia) and, when the affection was characterized by angiospasm, the four lower dorsal spines were concussed, whereas in angioparalyses, concussion of the 7th cervical spine was executed.

Results were achieved in practically all instances after repeated treatment, provided a reaction could be elicited, *i.e.*, when concussion of the 7th cervical spine would replace hyperemia by anemia, and when concussion of the spines of the four lower dorsal vertebræ would substitute hyperemia for anemia.

Very often the reaction could not be noted until after several treatments.

MIGRAINE (hemicrania; sick headache).—The pathology of this disease is obscure and the innumerable affections to which its origin has been attributed probably act as exciting factors of a basic condition, *viz.*, angio-ataxia. Many writers regard migraine as a vaso-motor neurosis; in fact, a former classification of two varieties of the affection is no longer viewed with tolerance by clinicians: 1, an angiospastic form characterized by pallor of one side of the face; 2, an angioparalytic form, manifested by redness of one side of the face. Those who support the vaso-motor theory of migraine contend that the early symptoms are caused by vasoconstrictor and the later symptoms by vasodilator influences. The author has treated about eight cases of migraine by concussion of the 7th cervical spine based on the theory of instability of the vaso-motor center in the spinal cord. The attacks were subdued in four cases, relieved in two patients and the attacks in two other patients were uninfluenced. The treatment must be executed in the interparoxysmal periods.

EXOPHTHALMIC GOITRE (Grave's, Basedow's or Parry's disease).—This disease is characterized by protrusion of the eyes (exophthalmos), enlargement of the thyroid gland, tremor and rapid heart-action (tachycardia). The theory which has gained most favor in explaining the symptoms of the disease is, that it is caused by a hypersecretion (hyperthyroidism) of the thyroid gland conducing to a kind of chronic intoxication. There is, however, a gap in the theory which evades the question, What causes the hyperthyroidism? Based on the results of his treatment, the author is constrained to believe that the disease is essentially an angioparalytic affection and that stimulation of the vaso-motor center in the cord by concussion of the 7th cervical spinous process suffices to relieve and even cure the affection in

question. Every successful method of treatment in this disease, medical or surgical, has been directed toward a reduction in the size of the thyroid gland, and it is reasonable to assume that one can stimulate or diminish the activity of this gland by increasing or diminishing its circulation.

Among the symptoms which yield most rapidly to treatment by concussion are tachycardia, flushing and tremor. Among six cases of the disease treated by the author the latter signs, plus the enlarged thyroid, were improved after a few treatments by concussion, but the exophthalmos in all but two cases persisted (although less pronounced). In all the cases, a decided retraction of the protruded eyes was noted after each treatment.

The following notes concerning one patient suffice to illustrate in the main the results of treatment:

> The patient presented all the cardinal symptoms of the disease. The pulse-rate was 160; tremor involved practically every muscle of the body; the slightest exertion was associated with perspiration; the thyroid was enlarged.
>
> After the third treatment by concussion, the pulse was 130, and after the eighth treatment, it was reduced to 88, and so remained after the patient was discharged. After the fifth treatment, the tremor was perceptibly diminished and perspiration following exertion no longer occurred. As shown in illustrations (Figs. 75,76), although the exophthalmos persisted, it was less conspicuous, whereas the thyroid gland is practically normal in size.

DIABETES MELLITUS.—The pathology of this disease is obscure. In the celebrated *piqûire* experiment of Claude Bernard, diabetes in an animal can be produced by irritating the floor of the 4th ventricle. Since then it has been shown that irritation of other parts of the nervous system will

produce diabetes. In consequence of the preceding, there has arisen a neurotic theory of diabetes which supposes it

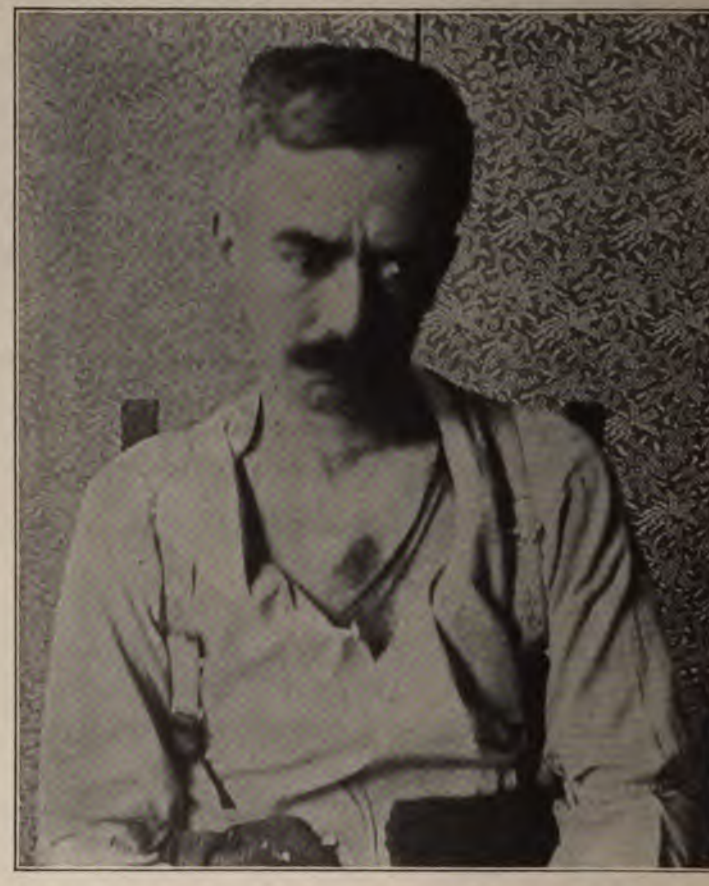
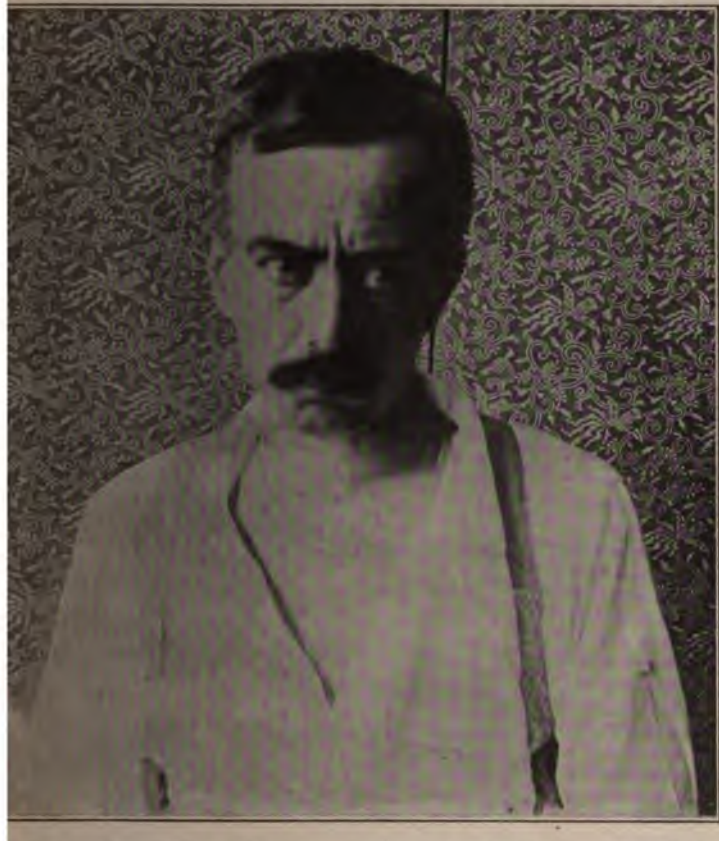


FIG. 75.—Photograph of a patient with exophthalmic goitre.

to be caused by a vaso-motor paralysis, resulting in a greater quantity of blood flowing through the liver.

The author, giving credence to the latter theory, has

ated ten diabetics by concussion of the spine of the 7th vical vertebra* and the results were as follows:



IG. 76.—Same patient after three weeks treatment (concussion of the spine of the 7th cervical vertebra).

1. No results in three cases.
2. The percentage of sugar very much reduced in four cases.

e author wishes to emphasize the following: In testing the methods of treatment employed throughout this book, recourse was had to no other therapeutic procedure. Not even *rest*, so essential in the treatment of aneurysm, was enjoined.

3. Slight reduction in the percentage of sugar in one case.
4. Disappearance of glycosuria in two cases. The duration of treatment in the latter cases extended over a period of one and two months respectively.

CORYZA (Cold in the Head).—The prevention and treatment of this condition is a constant rebuke to progressive medicine, insomuch as we have added nothing to that contributed by our medical ancestors. The sequelæ of a cold in the head include affections ranging from sinusitis to cerebral abscess. The prevailing theory regards coryza as a nasal infection varying in virulency according to the microbal cause. If, however, it were wholly an infection, then in a region so accessible to the employment of bactericides, the latter must be discredited. The infectious factor must be regarded in the same light as any other peripheral irritant which, acting reflexly upon the vaso-motor center, causes all the symptoms of an angioparalysis. This angioparalysis need not necessarily be excited from the nasal mucosa but from other vulnerable areas. The vaso-motor theory of coryza is partially sustained by the author's method of treatment, *viz., concussion of the 7th cervical spine.* When the latter is executed in the incipiency of the affection, it may be aborted. Later, it modifies the condition either by diminishing its severity or by altering the character of the discharge.

When the nose is obstructed in consequence of congestion of the nasal mucosa, a few concussion-blows on the spine of the 7th cervical vertebra will often overcome the obstruction as effectually as cocain, and the relief thus obtained may last from minutes to hours.

Very often the author instructs a friend of the patient to strike the spinous process (after the manner shown in Fig

3), whenever the nose is obstructed or, to execute it as a method of treatment, several times a day.

Naturally, the spinous process will become sensitive when concussed repeatedly and, in this event, it may be struck at different angles—directly or on one side or the other.

In *asthma*, reflexly provoked by congestion of the nasal mucosa, concussion as cited by giving immediate relief to the nasal congestion will inhibit the asthmatic paroxysm. The nasal mucous membrane is continuous with the lining membrane of the pharynx, Eustachian tubes, larynx, trachea and bronchial tubes and concussion is equally influential for weal in acute congestion of the same membrane irrespective of location. Thus many acute congestions of the bronchial mucosa may be aborted by concussion of the 7th cervical spinous process.

COLD EXTREMITIES.—This frequent condition has never, to my knowledge, been dignified by a technical name, and the author proposes the term *acropsychrosthesia*, signifying a feeling of cold in the extremities.

The effects of cold upon the skin (*dermatitis congelationis*) as in that common condition known as chilblain or pernio are really caused by insufficiency of the vaso-motor apparatus and the writer has successfully treated this obstinate condition by repeated séances of concussion of the spinous process of the 7th cervical spine. During treatment, if the parts are hyperemic, one may note definite areas of anemia in the hands, feet or face.

Many circulatory disturbances in the face, notably *acne rosacea*, are likewise vaso-motor neuroses and they also yield to the foregoing method of treatment.

ANGIOPARALYTIC NEUROSES.—In neurasthenia, hysteria and other neuroses, the vaso-motor symptoms seem to

dominate the clinical picture. Here the patient complains of pulsations throughout the body, notably the head, and the face is observed to be in a condition of hyperemia. Neurasthenics have a symptom in common: a feeling of heavy weight or constriction about the head. Charcot graphically described the head-sensation as the "*casque neurasthenique*," a feeling as though the patient were wearing a tight-fitting helmet. The author has never encountered in the literature any explanation of this phenomenon, and he is constrained to conclude that it is a vaso-motor symptom considering the beneficial results of treatment consecutive to the employment of concussion of the spinous process of the 7th cervical vertebra.

TOXIC CONDITIONS.—During the change of life or MENOPAUSE, the vaso-motor disturbances are almost as common as the arrest or irregularity of the menses. Flushing, heat and perspiration alternate with pallor and chills, and these symptoms often persist despite treatment to the end of life.

DIGESTION-AUTOINTOXICATION.—The author employs this term to signify a train of vaso-motor symptoms peculiar to some individuals who, after the ingestion of a meal, suffer from fullness and pulsations of the head, followed by throbbing in the arteries throughout the body. In association with these signs, the patients are depressed or despondent and are disinclined to execute their routine work. These symptoms are regarded as neurasthenic, but they are really due to autointoxication. Our conception of the latter affection is faulty, insomuch as we regard its causation to be associated with putrefaction of albuminoid food in the intestines. We forget that there are also poisonous albumoses, *i.e.*, intermediate products manufactured in the digestion of albuminous foodstuffs, and investigations show

that an aqueous extract of the contents of the small intestine is infinitely more toxic than an extract made from the contents of the large intestine.

Patients suffering from digestion-autointoxication experience relief as a rule, several hours after a repast.

In the treatment of these patients, the exclusion of albuminoid food is beneficial, but the best results are achieved if the vaso-motor center, which bears the brunt of the disturbance, is made resistant to the action of the poisons.

Here, treatment by concussion of the 7th cervical spine has given me excellent results.

CHAPTER VIII.

THE RESPIRATORY APPARATUS.

PHYSIOLOGY—HISTOLOGY—POSTURAL LUNG-DULLNESS—LUNG REFLEX OF DILATATION—LUNG REFLEX OF CONTRACTION—PULMONARY ATELECTASIS—BRONCHIAL ASTHMA—SPASMODIC BRONCHOSTENOSIS—TUBERCULOSIS—HEMOPTYSIS.

PHYSIOLOGY.

THE object of respiration is to exchange gases between the tissues and the external air. The blood circulating through the lungs absorbs oxygen from the alveolar air and yields its gaseous products of decomposition, notably carbon dioxid.

There are two phases of respiration:

1. Inspiration, which is effected by elevation of the ribs and by contraction of the diaphragm.
2. Expiration, which is a passive act and requires no muscular effort.

In man, the diaphragm predominates over the rib-lifting muscles, and the reverse is the case in women; hence, the normal type of respiration in man is abdominal, and in women, costal.

When this type of respiration is reversed (page 85), it becomes the fundamental condition of many respiratory neuroses and accentuates the symptoms of organic affections of the lungs.

In Fig. 77, two extreme types of respiration are indicated: A, the diaphragmatic, and B, the thoracic type. In A, there is no thoracic movement, but the anterior abdominal wall during inspiration projects to i. In B, on the contrary,

the thoracic wall moves forward and upward, whereas the abdominal wall instead of projecting is really drawn in.

The RESPIRATORY MECHANISM (Fig. 78) is regulated by the respiratory center in the medulla oblongata, the so-called *noeud vital* of physiologists, which corresponds in position with the vagus-nuclei. The muscles which enlarge and diminish the size of the thoracic cavity are innervated

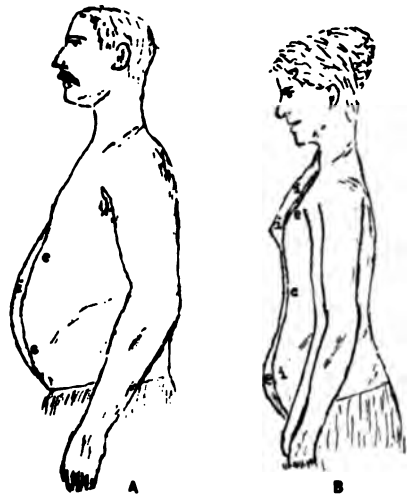


FIG. 77.—Diaphragmatic breathing in a male and the thoracic type of breathing in a female.

by nerves derived from the spinal cord; the diaphragm is supplied by the 3rd and 4th cervical roots and the phrenic nerve.

The motor nerves for the muscles of the larynx and bronchi run in the trunk of the vagus.

HISTOLOGY.

It is now known that longitudinal as well as circular muscular fibers exist in the finer bronchial tubes of rabbits, and Aufrecht has shown that a powerful layer of circular and a weaker layer of longitudinal fibers exist in man.

These *bronchial muscles* are under the influence of the vagi and can be made to contract and relax as the result of stimulation of the vagi. Thus we have bronchoconstrictor and bronchodilator fibers in the vagus.

The chief bronchoconstrictor reflexes are elicited from the mucous membrane of the nose and larynx.

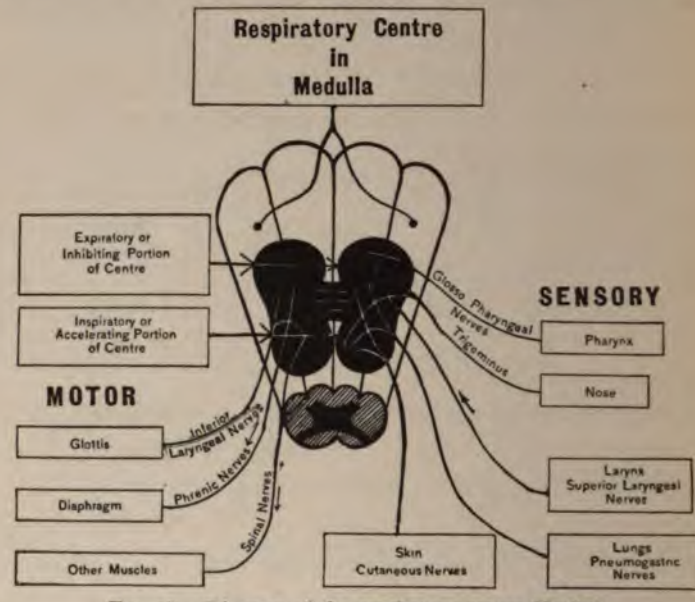


FIG. 78.—Diagram of the respiratory center (Butler).

The bronchial musculature is further discussed on page 308.

Recently, the presence of *vaso-motor nerves* in the lungs has been absolutely denied.

The author has referred[61] to a condition known as POSTURAL LUNG-DULLNESS.

Any one, however, reasonably skilled in percussion will, when attention is called to the fact, recognize a decided difference in the percussion note of the lungs if percussion

is made first in the erect and then again in the recumbent posture. One will also note a difference if the patient is percussed first leaning far forward and then backward (supported by an assistant). In other words (the author is assuming an average typical normal subject), the percussion changes correspond in a minor degree to the alterations in the percussion note when fluid is present in a pleural space. The changes noted would be as follows:

Leaning far forward: Anterior chest region diffused dullness, especially marked in a definite area. Posterior chest region hyperresonant.

Leaning far backward: Posterior chest region shows diffused dullness, notably in a definite area. Anterior chest wall elicits a hyperresonant percussion note.

Leaning to one side: Side of chest wall toward which patient inclines shows dullness, whereas the other side is hyperresonant.

Lying on one side: Side of chest on which the patient lies demonstrates dullness of the lung, including the apex, whereas the other side is hyperresonant.

Recumbent posture: The anterior thoracic wall is decidedly more resonant than in any other posture.

Prone posture: The posterior thoracic region is more resonant than in any other posture.

Exaggerated Trendelenburg: Slight dullness of the pulmonary apices; lower chest region hyperresonant.

Differential Diagnosis: Postural dullness as a pathological phenomenon is frequently encountered and may be confounded with the dullness of atelectasis. Dullness dependent on atelectasis is usually circumscribed and may be dispelled by a series of forced inspirations, rubbing the skin over the area of dullness to provoke the lung reflex of dilatation and by the cocain test (page 297).

Postural dullness is usually diffused, involving one or more lobes, and cannot be dispelled by forced inspirations, the cocain test, or by exciting the lung reflex. The dullness in question, however, disappears at once by a complete change in the posture of the patient. Assuming, for example, that the dullness is somewhere over the posterior surface of the chest, its dissipation cannot be effected until the patient assumes the prone posture.

Etiology of Postural Dullness.—After a careful consideration of this subject the author is constrained to conclude for the following reasons that the dullness provoked by posture is dependent on the blood normally present in the blood-vessels of the lungs, which is influenced by gravity, like any other fluid:

1. The blood in the lungs, unlike in other viscera, is not restricted in amount, owing to the absence of vaso-motor nerves. 2. The area of most pronounced dullness (as influenced by posture) corresponds to the situation of the largest pulmonary vessels, and is least manifested in areas where the vessels are less abundant. 3. In passive congestion of the lungs observed in cardiopaths, the dullness elicited by postural changes is most pronounced. 4. The postural dullness is uninfluenced by all the manœuvers which act upon either the bronchoconstrictor or bronchodilator nerves of the vagus.

Postural Lung Dullness in Disease.—As already observed, postural lung dullness is observed as a normal condition, or perhaps, to speak more definitely, in the norm, lung resonance is modified by posture. In passive congestion of the lungs it is most pronounced. In pulmonary tuberculosis I have noted only slight impairment of lung resonance as determined by posture, and this observation applies with equal cogency to the pretuberculous lung. For this reason

I seek to augment the quantity of blood in the apices of the lungs by having my tuberculous patients raise the foot of the bed so that the blood will gravitate toward the apices. After this manner I endeavor to induce a passive hyperemia of the regions in question. I cannot speak of results, inasmuch as this innovation has not been subjected to the test of time. Sir James Barr, in his erudite Bradshawe lecture before the Royal College of Physicians, London, refers to the frequency of atelectasis in exhausting diseases, which may be mistaken for a pleural effusion. He furthermore says: "Atelectasis is often mistaken for hypostatic congestion of the lung, and forcible rubbing of the affected side, acting through the lung reflex of Albert Abrams, causes some expansion of the lung and clears up the percussion note." My observations do not tally with the latter. On the contrary, ever since I recognized the method of differentiating lung atelectasis and lung hyperemia, I am convinced that what is frequently regarded as atelectasis is in reality a passive congestion.

Postural Dullness in Treatment.—The empirical treatment of pulmonary affections by external applications to the thoracic wall is fully justified, since the lung reflex of dilatation has been recognized. The postural treatment of diseases of the lungs is equally justified by the foregoing observations of the author. One fact, however, must be emphasized, and that is, the posture assumed by the patient must be an extreme one. Thus, to contend against hypostatic congestion the patient must assume the prone posture at least for a time several times a day. In hemoptysis, the correct posture can be determined when the area involved in the bleeding yields a resonant percussion note and indicates the exsanguination of the area in question.

THE LUNG REFLEX OF DILATATION.

This reflex demonstrates the important fact that the respiratory area may be influenced indirectly by stimuli acting on the vagi. In a contribution by Moscucci,[62] the suggestion was made that when ether was sprayed over the left half of the abdomen, marked reduction in volume of the spleen was observed in twelve cases. In repeating the experiments, I likewise noticed a decided reduction in the area of splenic dullness in all individuals on whom this method was tried, irrespective of the fact whether enlargement of the spleen existed or not. Investigations convinced me that this diminution in the area of splenic dullness was not real, but only apparent. When the ether spray was directed over the region of the heart, the percussional area of that organ was reduced at once; in fact, the superficial area of cardiac dullness could be obliterated by the manœuver. Similarly, when the spray was directed over the hepatic region the superficial area of dullness of that organ could be reduced at once. When the spray was directed over the border of the lungs posteriorly, the lung borders could be made to descend from two to four inches, dependent on certain conditions. It was further ascertained that dislocation of the lung-borders by forced inspiration never approached the dilatation of the lungs produced by the cutaneous application of the ether spray. Further experiments demonstrated in brief the fact that the application of any cutaneous irritant, whether the latter be mechanic, chemic or electric, would always induce *acute dilation of the lungs*. Even in emphysematous individuals the application of a cutaneous irritant still further augmented the existing lung-dilation. The question naturally arose, by what means could we establish the fact that the application of any

cutaneous irritant would cause acute dilation of the lungs, a condition which, it may be mentioned parenthetically, is only of a few minutes duration. Such a hypothesis was made tenable by the aid of conventional physical signs and the use of the fluoroscope. These aids show that when the skin is irritated by means of cold, by friction, or by a strong Faradic current, lung dilation will ensue. The degree of lung dilation is dependent upon the character of the irritant and the severity of its application. The response of the lung to dilation is always greatest in that part of the lung contiguous to the source of cutaneous irritation. Lung dilation may be recognized by the following physical signs: 1. Diminished respiratory excursions of the lung borders. 2. Extension of the pulmonary percussion note and obliteration of the cardiac and splenic areas of dullness. 3. Hyperresonance of the lungs. 4. Obliteration of the apex beat. Auscultation is of no value as a physical sign, inasmuch as the artificial dilation does not last longer than three minutes after the source of cutaneous irritation has been removed. Lung dilation spreads from the source of cutaneous irritation involving primarily circumscribed parts. In lungs showing resonance, the latter could always be increased by cutaneous irritation over the part percussed. The X-rays show how the brightness of the lungs is increased by cutaneous irritation. By gradually applying the irritant to different parts of the skin of the thorax, one may note that eventually the entire lung may be made to yield a more intense luminosity. This increased luminosity, however, does not last longer than three minutes in the average person, after which time the lungs resume their normal appearance.

In a number of measurements made during the study of the lung reflex after cutaneous irritation, I found

the average dislocation of the lower border of the lung, as follows:

Right sternal line	3½ cm.
Right parasternal line	3½ cm.
Right mammillary line	4 cm.
Right axillary line	6 cm.

In another communication, I demonstrated that acute dilation of the lungs can be evoked in healthy persons by irritation of the nasal mucosa and conversely, that this condition can be dissipated after the removal of the source of irritation. The pulmonary neurosis of dilation can be obtained by firmly compressing cotton in both nasal cavities. The degree of lung dilation with its concomitant phenomena will naturally vary according to circumstances which modify other reflex acts. After the introduction of the cotton, a few moments elapse before percussional results are noted. One will then observe superresonance and immobilization of the lung-borders and diminution of the areas of hepatic and cardiac dullness, in the latter instance, even to obliteration. Irritation of one nasal cavity with cotton does not yield manifest results. If the mucosa of both nasal cavities has been thoroughly cocainized before the introduction of the cotton, no lung dilation ensues. I have frequently encountered in my clientelè, individuals presenting the symptomatic picture of pulmonary vesicular emphysema in whom was associated, some abnormity of the nose. The anomaly was a simple coryza, spurs, deflection of the septum, hypertrophic rhinitis or polypi. At any rate, after eradication of the nasal anomaly, the symptoms of pulmonary dilation disappeared. The form of emphysema here cited is in reality an acute lung dilation, an eradicable condition dissociated with the anatomico-pathologic conditions conventionally allied with emphysema. The typic clinical picture

of acute lung dilation could nearly always be made to disappear by the aid of the *cocain test*, which constitutes in this form of pulmonary neurosis a diagnostic aid of unquestioned value. After application of a solution of cocain to the nasal mucosa, the lung-borders will recede and the lung resonance and normal vesicular respiration are restored. In patients suffering from *asthma* of presumable nasal origin, impaction of cotton in one or both nasal cavities may induce a typic asthmatic paroxysm. This fact is of undoubted diagnostic value. I maintain that the phenomena of lung dilation can be provoked at any point in the extensive course of distribution of the pneumogastric nerves, and that the stimuli may act indirectly on the vagi through the terminal fibers of the trigeminus or, by irritation of the cutaneous sensory nerves contiguous to the lungs.

It is necessary to hypothesize the existence of two distinct functions of the vagus nerve, or, at any rate, different fibers, with two distinct functions—fibers which can dilate (bronchodilator nerves) and fibers which contract (bronchoconstrictor nerves) the lungs upon application of the appropriate stimuli. In the action of these two sets of nerve fibers, the vasoconstrictor and vasodilator nerves of the vaso-motor system may be cited as analogous.

It may be interesting to observe that the author's hypothesis concerning the existence of bronchodilator and bronchoconstrictor fibers in the vagus was confirmed seven years later by the well-known physiologic investigations of Dixon and Brodie.

Respecting the *diagnostic value* of the lung reflex, attention has already been directed to its importance in *percussion* (page 204).

In England, Auld and Sir James Barr, and in Italy, Plessi, direct reference to the reflex in the differentiation of

atelectasis and consolidation of the lung; in atelectasis, irritation of the skin contiguous to the affected area will convert the dullness into resonance, whereas if the dullness is due to a consolidation, the lung reflex will not influence the dullness.

In x-ray examinations of the lungs, an area of opacity due to atelectasis may be mistaken for consolidation; the lung reflex would immediately clear the opacity in atelectasis but would not influence the shadow caused by a consolidation.

Cesare Minerbi, of Ferrara, Italy, regards the absence of the lung reflex posteriorly as one of the earliest and most trustworthy signs of pulmonary tuberculosis. This conclusion was based on a study of 300 cases and 14 autopsies.

THE LUNG REFLEX OF CONTRACTION.

Cherchevsky directed attention to a sign of early arteriosclerosis. He found that in the norm, the diameter of the aorta varies at different times. It became dilated if the region of the chest over the arch of the aorta is struck with the percussion hammer, while it shrinks in size if the blows are struck in the epigastrium. In arteriosclerosis it is impossible to produce these variations in diameter.

Cherchevsky has misinterpreted the phenomenon obtained by his manœuver. What he really elicits is a circumscribed lung-contraction adjacent to the part struck on the chest by the hammer and the blow on the epigastrium merely causes the collapsed lung-area to dilate (lung reflex of dilatation), thus supplanting dullness by resonance. Dullness may be elicited in practically any chest-region by using a plexor and pleximeter. The circumscribed dullness thus induced lasts but a few seconds, but may be made to disappear at once by striking the epigastrium.

Observed with the x-rays, the lung reflex of contraction

is an interesting study. After the blow is struck, the adjacent lung-area becomes gradually dark, showing that the air has been expelled from the lungs, whereas in a few seconds the lung-area becomes bright again. This lung reflex of contraction cannot be obtained if the nasal mucosa has been previously cocainized.

This reflex may be elicited from the nasal mucosa or the vertebral region so that both lungs are brought simultaneously into a condition of contraction and when the reflex is thus obtained, it proves of great therapeutic value in the treatment of *asthma* (page 312).

PULMONARY ATELECTASIS.

The proponent of any new method of treatment, may, in his enthusiasm, permit the imagination to run riot, thus presenting assumptions which can neither be demonstrated nor corroborated by experience.

The author has endeavored to avoid the Scylla and Charybdis of medical theorists and, for this reason, will only discuss certain diseases of the respiratory apparatus which experience has taught him can be successfully combated by methods advocated in this book.

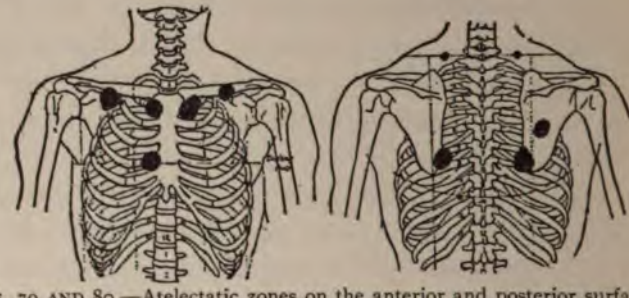
It is the accumulation of our experiences, observes Mundy, that makes our empirical knowledge, at last, scientific fact.

Pulmonary atelectasis or lung-collapse, refers to a condition in which the vesicles of an entire lung or only lung-areas are collapsed and contain little or no air.

We may here disregard the many causes of atelectasis and confine ourselves to the discussion of two frequent causes: 1. Obstruction somewhere in the air-passages (atelectasis of obstruction); 2. Defective expansion of the chest.

ACUTE BRONCHITIS is a common and very rarely a serious

disease in healthy adults. In young and old subjects, however, there is always danger of an extension of the catarrhal process downwards to the finer tubes, thus conducing to an atelectasis of obstruction. Such atelectatic areas are frequently the site of *broncho-pneumonic patches* or, as it is also called, capillary bronchitis. The author has frequently observed that in children suffering from broncho-pneumonia, the areas of dullness are not wholly due to the broncho-pneumonic condition, but to adjacent areas of atelectasis which may be readily be dissipated by elicitation of the lung reflex (page 294).



FIGS. 79 AND 80.—Atelectatic zones on the anterior and posterior surfaces of the thorax.

DEFECTIVE EXPANSION OF THE CHEST.—Any loss of inspiratory power may induce lung-collapse independent of any other factor. Weak and rickety children with their feeble muscular development lack this inspiratory power and one observes this enfeebled power in old age, long continued fevers and in individuals who are bedridden.

Even in the norm, certain portions of the lungs are collapsed and deprived of sufficient air to yield a dullness and, in some instances, flatness on percussion. Not infrequently, the apex of the lung in its entirety may be atelectatic and for this reason alone, some individuals have been pro-

nounced phthisical by physicians who fail to recognize atelectasis of the lung. These areas of lung-collapse or *atelectatic zones*, as the author has called them, usually disappear after a series of deep inspirations or upon application of the lung reflex test (page 298), *i.e.*, by vigorous rubbing of the skin over the site of atelectatic dullness.

Not infrequently, reflex irritation of the bronchoconstrictor fibers in the vagus by some anomaly of the nasal mucosa may maintain a condition of atelectasis. In the latter instance, cocainization of the nasal mucosa by inhibiting the action of the constrictor fibers will translate the dullness of an atelectatic patch into resonance.

In the accompanying illustrations (Figs. 79 and 80), a composite picture is projected defining the usual situation of atelectatic zones based on an examination of over one hundred apparently healthy individuals (children as well as adults).

These zones are frequently mistaken for areas of lung-consolidation, either when detected by percussion or seen at an X-ray examination. The zones bear a definite relation to the points of election and paths of distribution of the lesions in chronic pulmonary tuberculosis and they are frequently present in what the author has called "PULMONARY ANEMIA."

The latter condition is more frequent in children than in adults and fails to yield to ferruginous preparations. The syndrome of anemia, however, disappears after a course of methodic respiratory exercises. Should the anemia reappear, its recrudescence is almost invariably associated with a reappearance of the zones of atelectasis.*

*For a more extended discussion of the subject of *pulmonary anemia*, the reader is referred to the author's books, *Diseases of the Heart*, page 46, and *Diseases of the Lungs*, page 20.

TREATMENT OF PULMONARY ATELECTASIS.

Among the various methods for expanding the lungs and thus opposing the condition of atelectasis, the following manœuvers are suggested:

1. By action on the cutaneous sensory nerves.
2. By forced voluntary breathing.
3. By developing the muscles of respiration.
4. By aid of posture.
5. By vertebral concussion.

The two latter methods are advocated in cases of emergency.

I.—We have already shown that the lung reflex of dilatation and the heart reflex of contraction may be evoked by cutaneous stimulation. The stimulation of the respiratory center is greater through the cutaneous nerves than through the branches of the vagus to the respiratory organs. In animals which have been made apneic, cutaneous stimulation induced strong respiratory movements. We must therefore regard cutaneous stimulation as a simple and powerful stimulant of the centers of circulation and respiration.

The empirical treatment of pulmonary affections by external applications (poultices, friction with liniments and hot and warm compresses) to the thoracic wall is fully justified, since the lung reflex of dilatation has been recognized.

In acute pulmonary affections, and in infectious diseases like typhoid, the author employs carbonated baths and the cutaneous irritation thus induced powerfully influences cardiac and pulmonic vigor. In these affections we must be prepared to dismiss antipyresis as the great desideratum in the acute infectious diseases.

II.—Forced voluntary breathing may be achieved by

respiratory exercises and for rapid lung-development, the aid of the pneumatic cabinet is unquestionably the best method.

III.—Feebly developed muscles of the thorax may be strengthened by stimulation of the respiratory muscles peripherally or, better still, centrally (to secure symmetrical development, page 11), by aid of the sinusoidal current.

IV.—Reference has been made to postural lung-dullness on page 290. Here it is important to recall the necessity of frequent and complete changes in posture to obviate the tendency to atelectasis and passive congestion of the lungs.

V.—Concussion of the spines of the third to the eighth dorsal vertebræ will provoke a rapid dilatation of both lungs, thus inducing the lung reflex of dilatation which, however, is of short duration only; hence the necessity of a frequent repetition of the manœuver.

Other rapid methods of eliciting the latter reflex are:

1. Stimulation of the nasal mucosa by irritating vapors; strong vapors like those of ammonia must be avoided owing to their inhibiting action on the heart (Fig. 56).

2. By tapping the epigastrium lightly. Here, forcible percussion like the "*Klopf-Versuch*" of Goltz, will inhibit the heart's action.

3. By placing the patient in a warm bath and directing cold water from a pitcher to strike the nape of the neck and flow down the back.

BRONCHIAL ASTHMA.

If we regard this affection as a distinct neurosis of the respiratory apparatus, it may be defined as a series of paroxysmal dyspneic attacks in which no organic disease can be recognized in its causation. Whatever the etiologic factor, three conditions are essential:

1. Diminished resistance of the center of respiration.
2. Asthmogenic points somewhere.
3. Irritation of the asthmogenic points.

The asthmogenic point may exist anywhere in the course of the distribution of the vagus nerve, or the bronchoconstrictor fibers of this nerve may be irritated reflexly.

The usual sources of irritation are:

1. The nose. Here a probe may detect some sensitive spot (asthmogenic point) and irritation of this spot may induce a typic asthmatic paroxysm or symptoms approaching it like dyspnea or a feeling of constriction about the chest. In these cases of asthma of nasal genesis, if the nose is firmly packed with cotton (considering the fact that no asthmogenic point can be detected), an asthmatic attack may be elicited. A spray of cocain introduced into the nose may inhibit a paroxysm of asthma if it is of nasal origin. It is better in such cases to cocainize first one, and then the other nostril to determine which side of the nose is responsible for the irritation. By so doing, the side on which the nasal anomaly is present may be corrected and thus cure of the asthma may be effected.

2. The asthmogenic point may be located in the larynx (pharyngo-laryngeal asthma). Here, likewise, the probe may be used for diagnostic purposes.

3. The point of irritation may be intrabronchial dependent on bronchial catarrh and one observes in the interparoxysmal period all the symptoms of bronchitis. It is difficult, however, to determine during an asthmatic paroxysm which of the *râles* heard during auscultation are due to bronchitis and which to bronchial spasm. This question is determined by the author by having the patient inhale nitrite of amyl and carrying it to its full physiologic effects;

the *râles* due to spasm will disappear temporarily, whereas the *râles* of bronchitis will persist.

4. The source of irritation may be the stomach (dyspeptic asthma) caused by indigestion. Here an emetic or vomiting may inhibit an attack.* Intestinal worms may also cause asthma (asthma verminosum).

Among other causes of asthma may be briefly mentioned the sexual apparatus in men and women, the kidneys (renal asthma), the heart (page 212), malaria, hysteria, neurasthenia, etc.

Suggestion, as a factor, often casts discredit on the etiology of asthma just the same as it does on any other neurosis. The operations of the gynecologist and rhinologist, and the treatment of the neurologist act in many instances by the mere suggestion which is thrown out by the therapeutic manœuvers.

If asthma can be produced by suggestion, the same factor can cure it. Thus odors, particularly of flowers, may bring on an asthmatic paroxysm, and one physician induced an attack by allowing the patient to smell an artificial rose.

Of late, exposure of the chest to the action of the X-rays in asthma has been followed by cure, and here again, suggestion cannot be excluded. Thus I recall a patient who was brought to my office for an examination of the chest. She had asthma and the X-rays were used for a diagnostic object, yet her physician whom I saw several months later assured me that the patient was cured. She was under the impression that the rays were used for a therapeutic object and a single exposure sufficed to cure her.

There are numerous conditions, the number of which is rapidly multiplying, which are operative in etiology, and

**Vide* page 320, concerning the etiology of asthma from odors.

which, when corrected, lead to the cure of asthma. To relegate asthma to the category of the neuroses is a simple task, but to do so will deprive many sufferers from ultimate recovery. The trend of modern medicine is to deny the existence of functional diseases as mere entities, but to endow them with distinguishing attributes.

THEORIES OF CAUSE.

1. Spasm of the bronchial muscles.

2. Paralysis of the bronchial muscles leading to loss of expiratory power (Walshe).

3. A bulbar neurosis consisting of an excessive reflex irritability of the center of respiration (See).

4. A spasm of the diaphragm (Wintrich).

5. A spasm of the inspiratory muscles (Budd).

6. A microbic inflammation of the bronchial tree (Berkart).

7. Hyperemia of the bronchial mucosa analogous to urticaria (Clark).

8. The asthma-crystals found in the sputum of asthmatics irritate the peripheral ends of the fibers of the vagus and induce reflex spasm of the bronchial musculature (Leyden).

9. Swelling of the bronchial mucosa as demonstrated by tracheoscopic examination (Stoerk).

10. An exudative bronchiolitis which induces expiratory dyspnea (Curschmann).

11. Epilepsy of the lungs (Trousseau).

Among the more recent theorists, Kingscote contends that a dilated ventricle (right) of the heart predisposes to and maintains a condition of chronic asthma. He assumes that a paroxysm occurring at night is associated with the recumbent posture; the dilated heart striking the vagi

which lie immediately behind the heart on the bony spine.

The theory of Haig assumes that the uric acid in the blood irritates the vagi.

The x-rays, in the opinion of the author, who has examined many asthmatics during a paroxysm, show the incorrectness of several theories. Thus, while the diaphragm is retarded in its excursions, it is not sufficiently immobile to warrant the theory of diaphragmatic spasm.

Again, the heart does not approximate the spine in the recumbent posture to the extent of obliterating the triangular space between the heart and the spine; hence the author cannot accept the theory of Kingscote.

A study of the pathologic anatomy of bronchial asthma reveals the pertinent fact that nothing is suggested concerning the etiology of the disease and even the pathologist in consequence, contends that it is a reflex neurosis.

We are thus constrained to determine the pathology of the disease by clinical observations.*

Based on clinical observations, the author assumes the following theory concerning asthma: *A spasm of the circular muscular fibers of the bronchi with inability on the part of the weaker (paralytic) longitudinal fibers to expel the residual air imprisoned by the spasm of the circular fibers.*

The foregoing mechanism has its analogue in the bladder musculature, when, in consequence of a spasm of the sphincter vesicæ, the weak detrusor vesicæ cannot expel the urine and ischuria spastica results. The spastic retention

*A. G. Auld (*The Lancet*, Oct. 17, 1903), in commenting on "THE LUNG REFLEX OF ABRAMS," observes, "It was not, however, until recent years that anything like a satisfactory demonstration of the presence of bronchodilator, as well as bronchoconstrictor fibers in the vagus was made by Roy and Brown, and during the present year this seems to have been conclusively established by the work of Dixon and Brodie. But it undoubtedly stands to the credit of Abrams to have proved, at least, seven years since, by a simple *clinical observation* that the vagus must contain bronchodilator as well as bronchoconstrictor fibers."

of air in the lungs during an asthmatic paroxysm is schematically represented in Fig. 81.

In support of the author's *spasmo-paralytic hypothesis* of asthma, the following evidence is presented:

1. Histologic and physiologic facts.
2. Clinical facts: A. The picture of the asthmatic paroxysm; B. Results achieved by treatment.

FIG. 81.—A, the normal appearance of the terminal branch of a bronchial tube; B, in consequence of a spasm of the circular fibers the bronchial tube is partially occluded and, insomuch as this occlusion cannot be combated by the enfeebled longitudinal fibers (which can, in the norm, open the bronchial tubes when the latter are contracted) the retention of air causes a dilatation of the lung-structures peripheral to the site of occlusion.

Aufrecht[63] has shown that the musculature of the finer bronchi consists of a stout layer of circular and a weaker layer of longitudinal fibers. The clinical observations of the author, which were subsequently confirmed by the physiologic investigations of Dixon and Brodie, demonstrate that the vagus contains fibers which can either dilate or constrict the bronchi. The lung reflex of dilatation (page 294) demonstrates the predominant action of the circular fibers of the bronchial musculature, whereas the counter-

reflex of lung-contraction (page 298), shows the predominant action of the longitudinal fibers.

In asthmatics, the lung reflex of contraction is obtained with difficulty owing to enfeeblement of the longitudinal fibers, hence any therapeutic manœuver which will accentuate this reflex will arrest asthmatic paroxysms and will prevent their recurrence. This is the basis of the author's method of treatment in bronchial asthma.

In the norm, the lung reflex of contraction may be elicited in the following ways:

1. By forcible concussion over any area of the lungs by means of a plexor and pleximeter. This manœuver will only elicit a circumscribed lung reflex of contraction (page 298).

2. By inhalation of *amyl nitrite* after previous cocainization of the nose. Here the lung reflex of contraction, as evidenced by dullness of the lungs on percussion, is most conspicuous in the infraclavicular regions. It will be noted that amyl nitrite inhalations are currently employed to arrest an asthmatic paroxysm, but its effects are usually transitory. The reason for this is evident. Any irritant to the nasal mucosa will provoke the lung reflex of dilatation, but if the nasal mucosa is previously cocainized, amyl nitrite, like many other drugs, will reflexly stimulate the bronchoconstrictor nerves and by inducing the lung reflex of contraction will arrest an asthmatic paroxysm.

3. There are several preparations used in a nasal atomizer which are efficacious in arresting an asthmatic paroxysm but which are not curative. One is a secret preparation known as the *Nathan Tucker remedy.*

Coincident with the relief attending its use, the hyperresonant lungs become dull on percussion and the dullness is always in proportion to the relief obtained. In other

words, this preparation by provoking reflexly from the nose the lung reflex of contraction brings relief to the asthmatic. From various analyses made of the Tucker remedy, some claim that no cocain is present, but according to the observations of the author, it is impossible to obtain any decided effects without its presence. The author suggests the following as a cheaper substitute for the Tucker remedy:

Cocain.....3 per cent.
Atropin sulphate.....gr. ii.
Natrii nitrosi.....gr. ix.
Glycerin.....gr. xxx.
Aquæ destil.....oz. ss.
M.S.—Atomize for two minutes in each nostril and inspire deeply.

It may be necessary to reduce the percentage of atropin insomuch as in several instances mild atropin intoxication has followed the use of the spray.

4. By concussion of the spines of the 4th and 5th cervical vertebræ and by sinusoidalization of the same spines. This will be discussed under the treatment of asthma.

On page 297 reference was made to the cotton test in asthma. Here reference will be made to another test in support of the spasmo-paralytic theory of asthma. By concussing the spines of the dorsal vertebræ (3rd to the 8th), one may provoke a decided lung reflex of dilatation and in one predisposed to asthma, an attack or symptoms of an attack (dyspnea, constriction about the chest) may be provoked. If now, the spines of the 4th and 5th cervical vertebræ are concussed, the attack, or the symptoms, may be temporarily inhibited. In the first manœuver the lung reflex of dilatation brought the circular muscular fibers into action and in the second manœuver the action of the circular

fibers was inhibited by contraction of the longitudinal fibers.

5. By the *tracheal traction test.*[65] During the time the head is thrown forcibly backward, the normal resonance obtained by percussion over the manubrium, the anterior chest and the lower lobes of the lungs posteriorly, becomes translated into a dull or flat sound. This manœuver is called the tracheal traction test by the author and is similar to another vago-visceral reflex described elsewhere (page 321). This test is positive in health and in all cardio-pulmonary affections, but it is negative in all cases of idiopathic asthma. This test is present in the interparoxysmal asthmatic periods of asthma, and is thus of value in the differential diagnosis of other spasmodic affections which suggest an asthmatic genesis. Tracheal traction evokes contraction of the bronchial muscle by stimulation of the bronchoconstrictor nerves in the vagus. In asthma the tone of the bronchial muscle is so reduced that it no longer responds to vagus stimulation when the neck is forcibly extended on the sternum; hence the test is negative in asthma. The dull sound supplanting the resonance in the normal subject by tracheal traction is due to contraction of the bronchial muscle, which puts the air in the trachea and bronchi under considerable tension.

There is another affection closely related to asthma which the author has called SPASMODIC BRONCHOSTENOSIS, and in which, like asthma, the tracheal traction test is negative. Patients with bronchospasm suffer from a persistent spasmodic cough, with or without expectoration, in other words, spasmodic bronchostenosis is asthma without paroxysms.

Many physicians have encountered persistent spasmodic coughs in subjects with bronchitis and have no doubt com-

mented on the intractability of the cases. In such instances, a *bronchospasm* complicates the disease. Here climate yields immediate results. The patients often lose their spasmodic cough at once if sent to another climate. Here the spray described on page 310 is very efficient in controlling the spasmodic cough, and the same may be said of the smoke from various antispasmodic agents. The following formula, which owes its efficacy to pyridin, may be used:

Powdered stramonium. . . . . .
Powdered belladonna. . . . . .
Powdered hyoscyamus. . . . . .
Powdered potassium nitrate. . . . . aa 1 oz.

M.S.—Burn one-half teaspoonful or more and inhale fumes.

6. The picture of an asthmatic paroxysm suggests the spasmo-paralytic theory. The lungs are in an acute emphysematous condition, and the dyspnea is expiratory in character. The moment the spasm is relaxed by appropriate treatment, the lung reflex of contraction is provoked.

The table on page 212 gives the *differential diagnosis* of cardiac and bronchial asthma.

TREATMENT OF BRONCHIAL ASTHMA.

An attack of asthma may be jugulated by any manœuver which will promote the expiratory phase of respiration or which will induce the lung reflex of contraction. The author recalls a patient seen in consultation, whose asthmatic paroxysm was of two days' duration despite complete anesthetization with chloroform and recourse to the conventional methods yet, a few minutes rhythmical compression of the chest during expiration sufficed to control the attack. This simple method has been used with success in other cases.

As before remarked, the lung reflex of contraction can

be provoked by concussion of the spines of the 4th and 5th cervical vertebræ and, in the absence of a hammer and plexímeter, the hands may be used (Fig. 3). The latter manœuver often succeeds in arresting a paroxysm, but it may be necessary to repeat it several times. In the treatment of asthma, one frequently observes astonishing cures reported by the rhinologist and other specialists. Here the source of irritation (asthmogenic point) is removed, but the enfeebled condition of the bronchial musculature is uncorrected and any other irritant may be operative in provoking an attack.

In the following method of treatment suggested by the author, an attempt is made to increase the vigor of the longitudinal fibers of the bronchial musculature with the object of inducing the lung reflex of contraction. This is best effected by a strong sinusoidal current—one electrode over the spines of the 4th and 5th cervical vertebræ and the other electrode over the sacrum. The treatment must be executed daily and each séance may last from fifteen minutes to one hour. Very often an interrupting electrode at the cervical region may be advantageously employed with the object of exciting more vigorously the bronchoconstrictor fibers of the vagus. All sinusoidal machines are not equally efficient, and to test the latter one electrode is placed over the spines of the 4th and 5th cervical vertebræ in a normal subject and the other electrode over the sacrum. If the former lung-resonance is converted into dullness, after a few minutes action of the current, the latter is efficient, and its efficiency is always in proportion to the degree of lung-contraction which it provokes. This method of treatment will often yield phenomenal results even in cases of asthma of many years' duration.

Until the bronchial musculature is strengthened, the

attacks of asthma will continue (with less violence) and to combat the attacks, the nasal spray (page 310) may be used.

Adrenalin chlorid is one of the most efficient agents in inhibiting an attack of asthma, and the author employs it in doses of from eight to fifteen minims hypodermatically. The action of this drug is to provoke the lung reflex of contraction and, when effective in asthma, the previously

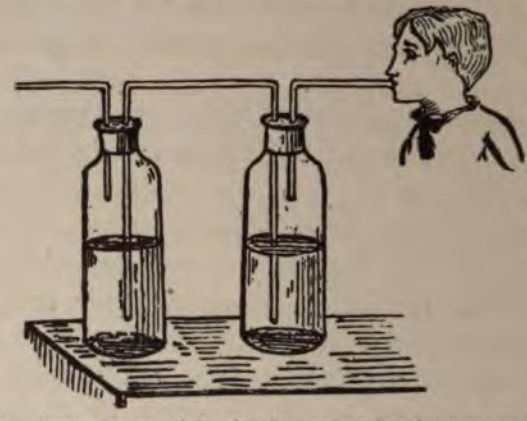


FIG. 82.—Arrangement of bottles for promoting lung-contraction.

resonant percussion tone of the lungs is converted into a dull or flat sound. Like action on the percussion sound is observed in the normal subject.

In addition to sinusoidalization as suggested, the patient should be instructed to execute respiratory exercises at least twice daily with the object of increasing the expiratory force. The latter is best attained by extinguishing with the breath the flame of a candle; the distance of the latter from the patient is gradually increased. At first, the effort of blowing may provoke asthmatic symptoms, but gradually the latter yield. The latter method may even be employed in arresting an asthmatic paroxysm.

Another efficient method of promoting the muscles of expiration is to instruct the patient to practice daily for a definite time, to blow water by air-pressure from one bottle to another. Each bottle should hold, at least, a gallon, and by the arrangement of tubes, as in the Wolff bottle, the force of expiration will transfer the water from one bottle to another (Fig. 82). Osler and others claim that the method just cited will expand the lungs, but the author has shown that the effect is to contract the lungs.

EMPHYSEMA is an affection associated with enfeeblement of the longitudinal fibers of the bronchial musculature. Here sinusoidalization as suggested in the treatment of asthma (page 313) is often very efficient in the treatment of emphysema provided, one can elicit the lung reflex of contraction (dullness of the lungs on percussion) even in a moderate degree.

TUBERCULOSIS is associated with a too voluminous lung and the lungs are practically in an emphysematous condition. The lungs always show deficient expiratory force. Here the bronchial musculature may be brought to contraction by sinusoidalization as in the treatment of asthma (page 313).

HEMOPTYSIS may yield to posture (page 293) and the inhalation of amyl nitrite carried to its physiologic effects *after cocainization of the nose*. This is the most efficient drug we possess in arresting hemorrhage of the lungs. Unless it is efficient after the first inhalation, it is usually without any action. The blood-vessels of the lungs have no vaso-motor nerves and any constriction of the blood-vessels must be effected by provoking the lung reflex of contraction. Cocainizing the nose increases the efficacy of the inhalations. Whereas, amyl nitrite may effect its object without the previous use of cocain, the latter drug increases its efficacy for the reason cited on page 309.

CHAPTER IX.

THE DIGESTIVE SYSTEM.

THE STOMACH—THE STOMACH REFLEXES—PERCUSSION OF THE STOMACH—TREATMENT OF DISEASES OF THE STOMACH—THE INTESTINES—THE INTESTINAL REFLEXES—DISEASES OF THE INTESTINES—TREATMENT OF CONSTIPATION—THE INTESTINAL NEUROSES.

THE STOMACH.

By means of the *movements of the stomach* the food is mixed with the gastric juice. The motor nerves of the stomach are derived from the vagus and sympathetic nerves. Fig. 83, after Openchowski, shows the nerves of the musculature of the stomach.

THE STOMACH REFLEX OF CONTRACTION.**

This consists of a contraction of the walls of the stomach elicited by the following manœuvers:

1. Concussion of the Traube area.
2. Concussion or sinusoidalization of the spines of the three first lumbar vertebræ.
3. By elicitation of the vago-visceral reflex.
4. By pressure in definite paravertebral areas.

I. The Traube area or space (Fig. 84) is that half-moon-shaped space which normally yields on percussion a tympanitic sound, owing to the presence of the cardiac end of the stomach. It is bounded above and laterally by the contiguous borders of the liver, lung and spleen. Fixing our pleximeter firmly in the center of the Traube area of tympanicity, we strike the pleximeter with a hammer a series of vigorous blows, and then proceed to percuss the

area of Traube. One observes at once that this region which formerly yielded a tympanitic sound now presents on

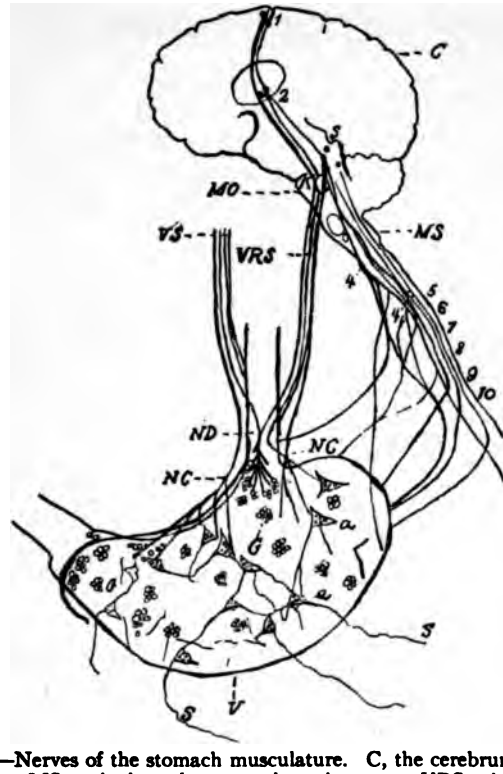


FIG. 83.—Nerves of the stomach musculature. C, the cerebrum; V, stomach; MO, medulla; MS, spinal cord; 5-10, thoracic roots; VRS, right vagus; VS, left vagus; ND, dilators of the cardia; NC, constrictors of the cardia; A, Auerbach's plexus; S, S, fibers from the sympathetic plexus; 1, sulcus cruri atus; 2, corpus striatum; 3, corpus quadrigemina; 4, centers in the spinal cord. The dilator center for the cardia inbibits the movements of the pylorus.

percussion a dull or even flat sound. The phenomenon thus elicited is the stomach reflex of contraction.

II. Concussion of the spines of the 1st, 2nd and 3rd lumbar vertebræ will also produce the stomach reflex of contraction.

III. *Vide* percussion of the stomach, page 321.

IV. Firm and deep pressure with the thumb alongside of the spines of the first three lumbar vertebræ on the left side will also elicit the reflex in question.

THE STOMACH REFLEX OF DILATATION.

This reflex, consists of a dilatation of the stomach provoked by irritation of the skin over the area of Traube,

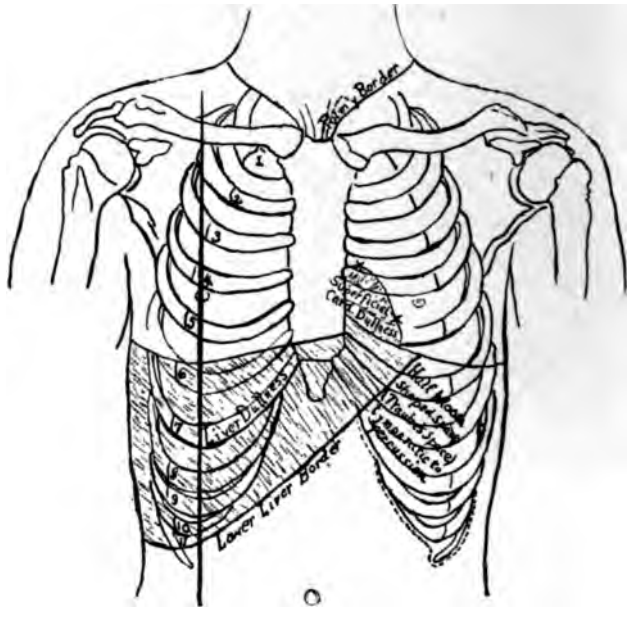


FIG. 84.—Normal percussion-boundaries of the lungs, liver and spleen, and Traube's space—anterior view (Sahli).

after tapping the epigastrium, by deep and firm pressure to the left of the spine of the 11th dorsal vertebra and by concussion or sinusoidalization of the latter spinous process (Fig 85).

Both stomach reflexes may be confirmed by the vago-visceral reflex which is described under percussion of the stomach.

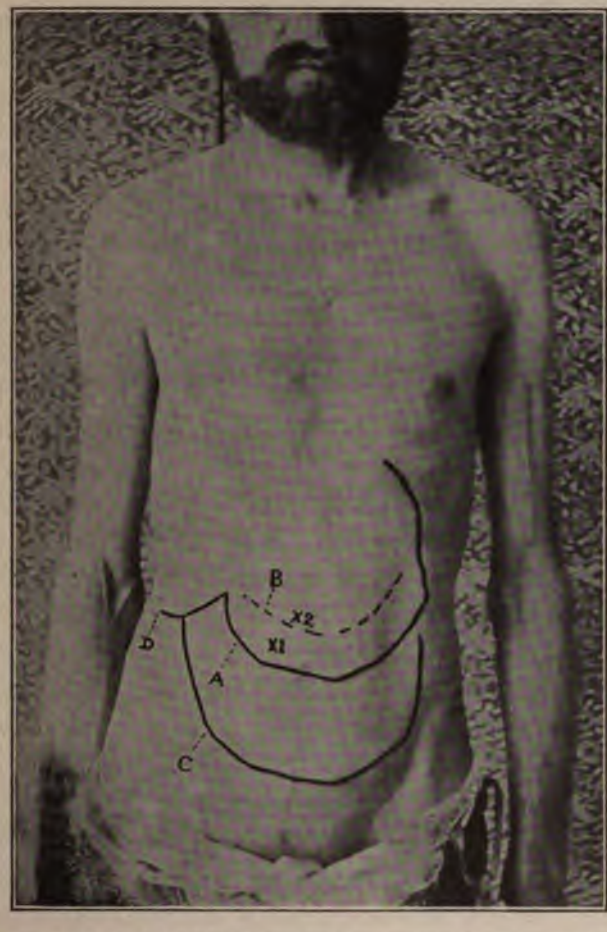


FIG. 85—Effects of the inhalation of ether on the stomach: continuous line , the lower border of the stomach before and (C), after the inhalation of ether. o illustrating area of gastric tenderness. If a point of tenderness exists at x1, shifted to x2, after eliciting the stomach reflex of contraction, which causes lower border of the organ to recede from A to B.*

lation of the fundus is not shown, although it occurs. This illustration is further described on page 323.

There is, perhaps, no greater excitant of the stomach reflex of dilatation than irritation of the nasal mucosa by irritating vapors. The effects of inhaling ether are shown in Fig. 85. The reflex in question thus excited is of longer duration than any other visceral reflex. In one patient the stomach remained dilated for fully eight hours. Chloroform vapor is less active than ether in provoking the reflex. In this reflex the fundus of the stomach likewise dilates and the author believes that the *asthma from odors* is due to pressure of an acutely dilated stomach on the heart. Thus, one patient who suffered an asthmatic paroxysm from the odor of hay, demonstrated an enormously dilated stomach. When the latter was reduced by concussion of the spines of the first three lumbar vertebræ, the paroxysm ceased. When the nose was previously cocainized, no asthma could be provoked from the odor of hay. The effect of insufflation of the stomach on the heart is shown in Fig. 33.

In the literature, a number of cases of *acute dilatation of the stomach* have been reported following operations which are characterized by sudden onset, symptoms of collapse and vomiting of large quantities of fluid. The cause is obscure, but the author's investigations seem to show that the dilatation is associated with the irritating action of the vapors employed as anesthetics. Here the condition is a reflex due to irritation of probable gastro-dilator fibers in the vagus. As the author has shown (page 202) irritating vapors will inhibit the heart, but if the nose has been previously cocainized such action does not ensue. He therefore suggests the use of cocain in the nose as a routine method before employing anesthetics to inhibit the action of the vapors on the heart and on the stomach. Fig. 85 shows the effects of inhalation of ether (duration of inhalation, one minute) on the stomach.

It may be noted that concussion of the spines of the first three lumbar vertebræ will at once reduce the lower border of the stomach to the norm; otherwise the dilatation continues for some time. Such concussion may be of service in acute dilatation of the stomach following operations.

PERCUSSION OF THE STOMACH.

No gastrologist can lay any claim to distinction in his chosen speciality until he has devised some original method for percussing the stomach, and the result has been a number of complicated and, in some instances, faulty methods of examination. The author contends that any physician who is able to appreciate percussion-sounds can accurately percuss not only the lower border of the stomach, but the upper border of the organ as well (Fig. 86) by the following simple method which elicits the vago-visceral reflex of stomach-contraction.

By directing the patient to draw the head slowly backward, though forcibly, thus inducing hypertension of the cervical muscles, the pneumogastric nerves are stimulated and this stimulation is manifested clinically:

1. By inhibition of the heart (page 228).
2. By the tracheal traction test (page 311).
3. By the stomach reflex of contraction.

To obtain the latter reflex, the borders of the stomach are percussed during the time the patient forcibly extends his head as far back as possible. When he is unable to do this satisfactorily, an assistant may do it for him. During the time tension of the muscles of the neck is maintained, the stomach yields a dullness on light percussion with the patient standing.*

*The dullness is accentuated if an assistant compresses the spinal column during percussion (page 80).

To explain the altered percussion sound in the stomach reflex of contraction, one must have recourse to the Skodaic interpretation of the condition which exists when dullness supplants tympanicity. In the stomach reflex of contraction, the gastric walls become tense, thus putting the air or gas within them under increased tension, and, for this reason, we have the physical elements necessary for the transition of a tympanitic to a dull sound.

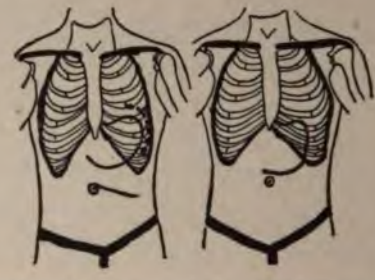


FIG. 86.—Percussion of the stomach by aid of the vago-visceral reflex (the head to be fixed as shown in Fig. 65). The illustration with the dotted line indicates an increased area of the organ after irritation of the skin of Traube's area. The other illustration demonstrates the outline of the stomach in a case of gastroptosis.

Reference to Fig. 5 shows that concussion of the spines of the first three lumbar vertebræ is not available for percussion. While the latter manœuver is advantageous in treatment, it also provokes the intestinal reflex of contraction and as the latter yields a dullness on percussion, the dullness of this reflex cannot be differentiated from the dullness of the stomach reflex of contraction.

THE STOMACH REFLEX OF CONTRACTION IN DIAGNOSIS.

Reference has already been made to the value of this reflex in percussion of the stomach.

It remains to consider its value in determining the *motor power* of the organ and the *localization of pain.*

Having determined the lower border of the organ by aid of the vago-visceral reflex, we concuss rather forcibly the area of Traube and note the difference of the lower border before and after such concussion. Naturally, the head must be maintained properly during the time percussion of the stomach is executed. It will be noted in Fig. 85, that the lower border of the stomach shifts from A to B, which represents the degree of the stomach contraction which is in direct ratio to the motor power of the organ. In the norm the degree of recession of the lower border of the stomach varies from 2 to 4 cm.

Let one assume that the patient has a fixed point of sensitiveness in the epigastrium and it is a question whether this area of tenderness is or is not associated with the stomach. In the former event, concussion of the area of Traube by causing contraction of the stomach, will shift the area of tenderness from X1 to X2 (Fig. 85). Within a minute, however (the duration of the reflex), the area of tenderness will again be located at X1*.

The presence of a *growth* and its association with the stomach may be shown to exist by aid of the stomach reflex, for elicitation of the latter will cause a dislocation of the growth upward and to the left. Eliciting the stomach reflex of dilatation (concussion of the spine of the 11th dorsal vertebra) will cause an area of tenderness or a growth to be dislocated downward.

*The author suggests this manœuver in the differential diagnosis of a gastric and duodenal ulcer. The employment of this manœuver will not cause a dislocation of the area of tenderness on palpation if the ulcer is duodenal.

TREATMENT.

MOTOR-INSUFFICIENCY, or lack of power of the muscular wall of the stomach to discharge its contents, results from many causes, notably the burden thrown upon it by indiscreet eating. This insufficiency of the organ, which practically always eventuates in dilatation of the stomach (gastrectasis), is usually regarded as a dyspepsia, insomuch as the symptoms are dyspeptic in character. Many so-called neuroses of the stomach are dependent on the same cause. The author realizes that he gives expression to heterodoxic views when he attempts a classification of all diseases of the stomach into two main classes: organic and functional. To the former belong chiefly ulcers and tumors, whereas, the latter are not diseases but merely symptoms. In his early professional career, the author religiously executed the conventional gastric analyses, and while he was able to determine anomalies in the gastric secretion, he rarely succeeded in curing his patients; he was successful as a diagnostician and a failure as a therapeutist. The moment he departed from traditional lines and sought a constitutional cause for the symptomatic affections of the stomach, he began to achieve a modicum of success in the treatment of his cases.

There is an element of nervousness in all dyspepsias, and this nervousness is maintained by an enervated nervous system. In all instances of functional diseases of the stomach, treatment must be addressed to an enfeebled nervous system; this is essentially the basis of gastrotherapy.

In the experience of the author, the most constant condition identified with functional diseases of the stomach is an insufficiency of the muscular walls with a moderate dilatation of the organ and the relief of this condition, which

is possible after the manner to be cited, is of greater value than any other symptomatic method of treatment.

To contract the stomach and to augment the tone of its musculature two methods are available: 1. By aid of the sinusoidal current; one electrode over the space of Traube and the other over the spines of the first three lumbar vertebræ. 2. By concussion of the spines of the first three lumbar vertebræ. Treatment by either method must be executed daily and each séance should, at least, last fifteen minutes.

In gastric or intestinal TYMPANITES, concussion of the spines of the first three lumbar vertebræ to elicit the stomach and intestinal reflexes is a very effective method.

THE INTESTINE.

The movements of the intestine are controlled by the central nervous system and the small intestine receives its efferent nerves through the vagus and the splanchnic. Respecting the action of these nerves there is no unanimity of opinion. It may be remarked, however, that vagus-stimulation by contraction of the muscles of the neck (page 228) while it influences the heart, bronchi and stomach, is absolutely without any influence on the percussion sound of the intestine.

THE INTESTINAL REFLEX OF CONTRACTION.

This reflex consists of a contraction of the intestine and is evidenced by dullness on percussion supplanting the tympanitic tone prior to the elicitation of the manœuver. Of all the visceral reflexes described by the author, this particular reflex is of longest duration. In some individuals it may persist for five or more minutes, and it is more evident and longer in duration in children than in adults. It is

best elicited by concussion or sinusoidalization of the spines of the first three lumbar vertebræ. Firm and deep pressure alongside of the spines of the first three lumbar vertebræ (Fig. 48) will also evoke this reflex; pressure on the right side of the spines in question will contract the intestine only on the right side, whereas pressure on the left side will only influence the intestine on that side.

Concussion of the spines in question, however, evokes contraction of the intestine on both sides.

THE INTESTINAL REFLEX OF DILATATION.

This reflex consists of a dilatation of the intestine and may be elicited in one of the following ways:

1. By irritation of the skin of the abdomen. Here the intestinal dilatation is very circumscribed and practically limited to the area of cutaneous irritation.

2. By firm and deep pressure at the side of the spine of the 11th dorsal vertebra. Here the intestinal dilatation is limited to either the entire right or left side of the abdomen dependent on the side subjected to pressure.

3. By concussion or sinusoidalization of the spine of the 11th dorsal vertebra. Concussion is more potent than sinusoidalization in discharging this reflex. Here the intestinal dilatation involves all of the intestine. The reflex of dilatation is less pronounced and of shorter duration than its counter-reflex of contraction.

DISEASES OF THE INTESTINES.

It is generally conceded by the gastro-enterologist that in intestinal and gastric diseases, the chemical or digestive functions are subservient to the more important motor functions. In the functional intestinal diseases, one again notes muscles in antagonism (page 11), and the anomaly

in function is expressed by the predominant action of either the longitudinal or circular muscular fibers. The *movements of the intestines* as revealed to us by the physiologist are of little or no clinical value. The chief form of intestinal movement is known as peristalsis. The peristaltic movement is essentially a constriction of the intestinal wall, commencing at a definite point and passes downward from segment to segment, whereas the parts behind the advancing zone of constriction relax slowly. The physiologist does not account for the action of the longitudinal fibers in peristalsis, but assumes that, insomuch as constriction is the attribute of the circular layer of muscles, the latter layer is the chief factor in peristalsis.

CONSTIPATION.

In one class of patients, constipation may exist without any symptoms, whereas others complain of headache, anorexia, lassitude, mental depression, etc. The latter symptoms have been dignified by the term *copremia*, which is supposed to indicate fecal poisoning. The fetich of many neurasthenics is the water-closet, and the elysium of others is a purgative. It is easier to take a simple pill than to pursue a prolix dietetic régime, hence the prestige of the purgative habit.

What constitutes constipation? We do not, as a rule, seek to analyze this question, and content ourselves with the bare statement of the patient. Grant suggests the following test for constipation: The patient is given a tablespoonful of animal charcoal. Normally it appears in the stools in twenty-four hours. By this means, even though the patient affirms that he is or is not constipated, the charcoal test will decide the question. Dr. C. M. Cooper of San Francisco, resorts to the following test to determine the origin of

constipation. The test is based on the fact that, in the norm, the passage of charcoal or bismuth (which blacken the feces) from the stomach to the rectum is attained in from twelve to forty-eight hours. If more than seventy-two hours elapse before colored feces are detected in the rectum, constipation is present. Hertz, of London, has shown that, if after the lapse of forty-eight hours the rectum is empty, or, as Cooper shows, if the sigmoidoscope demonstrates the presence of blackened feces lodged in the sigmoid, there is some retardation from the middle of the transverse colon. If the feces lodge in the rectum longer than twenty-four hours, then the constipation is rectal in origin, dependent on one of the following causes: Loss of the reflex of defecation from anesthesia or neglect (indolence, false pride, pain of fissures or hemorrhoids), atony or paresis of the rectum and weakness of the voluntary muscles of defecation.

One must differentiate two forms of constipation: atonic and spastic. In some instances the latter are combined.

ATONIC CONSTIPATION is recognized by the dilated intestines which cause a protuberance of the abdomen and percussion of the latter yields a tympanitic sound. Here, concussion of the spines of the first three lumbar vertebræ, fails to yield as in the norm a decided intestinal reflex of contraction as revealed by the dull percussion note. Not only are we thus able objectively to determine this form of constipation, but can also say what part of the bowel is implicated. Very often the dullness is obtained only over the ascending or descending colon, showing that wherever dullness is obtained, that portion of the intestinal canal is not involved in atonic constipation.

SPASTIC CONSTIPATION is less frequent than the atonic form. The former is caused by a tonic contraction of intestinal segments which hold back fecal masses, whereas

the latter is dependent on an inherent enfeeblement of the intestinal musculature. There is always a feeling in the spastic form as if the evacuation were unsatisfactory. The patients press a great deal at stool and evacuate long, thin and flattened fecal masses.

On palpation of the abdomen one may detect localized contractions, especially of the transverse colon (*corde colique*). The implicated intestinal segment may be rolled under the finger like a cord. Percussion over the spastic intestinal areas yields a dull in lieu of a tympanitic sound. Normally, when one scratches the abdominal skin over a dull intestinal area, or by a few blows directed against the epigastrium, the dullness becomes tympanitic, owing to temporary dilatation of the intestine (intestinal reflex of dilatation). The percussion sound of the spastic intestine does not change. As a rule, the spastic form does not lead to meteorism, yet in rare instances, there may be symptoms corresponding to ileus and even celiotomy has been performed by mistake.

In the spastic form not only are cathartics useless, but they accentuate the symptoms. When olive oil is effective in constipation in tablespoonful doses one-half hour before each meal, it is almost diagnostic of the spastic form of constipation.

TREATMENT OF CONSTIPATION.

Whatever treatment is employed in this condition, one must always conciliate a psychic factor. The psychic factor takes into consideration the fact that the desire to go to stool is a habit. Habit in itself is a great economizer of nerve-force, for it is automatic in action and reduces cerebral participation to a minimum.

Thought directed toward a part will increase its functional activity. The mental state influences the intestinal canal

and one may recall the frequency of nervous diarrhœa. The diarrhœa of students before an examination, of nervous women and men during transient periods of excitement, etc., is of this nature. Canstatt tells of a surgeon who had an attack of diarrhœa before every important operation.

From what has preceded, the treatment of *atonic constipation* consists in methods which have for their object the elicitation of the intestinal reflex of contraction. In the experience of the author, the latter is best elicited by sinusoidalization or concussion of the spines of the first three lumbar vertebræ. Concussion appears to be more effective in the treatment of atonic constipation. If the sinusoidal current is employed, one electrode is fixed over the sacrum and the other over the spines of the first three lumbar vertebræ. Strong currents must be used and the daily séances should last fully fifteen minutes. Within a week, usually, the treatment is effective, but must be continued thereafter less often.

Spastic constipation is remedied by the method for eliciting the intestinal reflex of dilatation, *viz.*, sinusoidalization or concussion of the spine of the 11th dorsal vertebra.

When neither form of constipation predominates, sinusoidalization or concussion at the same séance may alternate between the spine of the 11th dorsal vertebra to stimulate the longitudinal muscular fibers and the spines of the first three lumbar vertebræ to excite contraction of the circular fibers of the intestines.

INTESTINAL NEUROSES.

Among the motor neuroses favorably influenced by the methods suggested in this work are the following:

1. NERVOUS DIARRHŒA.—This condition presumes an absence of all anatomic changes in the intestinal wall. The

subjects are usually neuropaths. The treatment consists of alternate toning of the circular (concussion or sinusoidalization of the spines of the first three lumbar vertebræ) and longitudinal muscular fibers of the intestines (spine of the 11th dorsal vertebra).

2. PERISTALTIC UNREST.—In this condition (*tormina intestinorum*) patients suffer from loud noises, which may often be heard by others. The peristaltic movements may be so loud as to interfere with sleep. The movements are often visible and may be palpated. The same treatment may be used as indicated in nervous diarrhœa.

3. ENTEROSPASM.—In this condition the intestinal spasticity may be limited or diffused, and in the latter instance the abdomen is retracted.

Enteralgia is quite independent of the colicky pains observed in enterospasm and is caused by a tetanic contraction of the enteric musculature. The treatment in both affections consists of relaxing the spasm by concussion or sinusoidalization of the spine of the 11th dorsal vertebra.

4. NERVOUS CONSTIPATION.—This is frequently associated with atony of the intestines and the subjects are usually hysterical and suffer paroxysmally from meteorism. There is always a tendency to *meteorism* whenever there is any weakness of the intestinal musculature. The treatment of this condition is similar to that described under nervous diarrhœa.

THE LIVER.

There are two LIVER REFLEXES: that of contraction and that of dilatation. The *liver reflex of contraction* may be elicited in three ways:

1. By irritation of the skin over the liver.
2. By fixing a pleximeter anywhere in the hepatic region

and striking the pleximeter a series of vigorous blows with a hammer.

3. By concussion or sinusoidalization of the spines of the first three lumbar vertebræ.

The latter manœuver is the most effective. By any of the foregoing methods, percussion demonstrates (Fig. 87) a contraction of the liver. In percussing the lower border

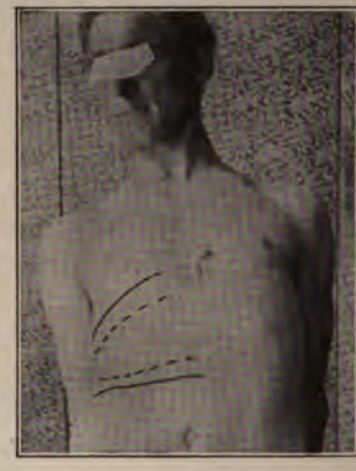


FIG. 87.—Demonstrating the liver reflex of contraction. The continuous lines represent the borders of the organ before and the interrupted lines the borders after eliciting the liver reflex of contraction. The latter reflex in this patient was elicited by concussion of the spines of the first three lumbar vertebræ. The liver in the mammary line measured 12 cm. and was reduced to 7 cm.

of the liver, the dullness of the lower border of the organ is facilitated by inclining the body backwards or by having an assistant fix the hand upon the spinal column to prevent vibrations of the latter (Page 80).

The *liver reflex of dilatation* is evidenced by an enlargement of the organ subsequent to the execution of the following manœuvers:

1. By deep and firm pressure with the finger to the right of the spinous process of the 11th dorsal vertebra (Fig. 48).

2. By sinusoidalization or concussion of the spine of the 11th dorsal vertebra. This is the more effective of the two methods.

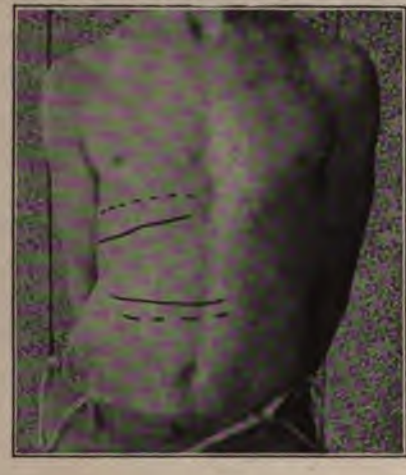


FIG. 88.—Illustrating enlargement of the liver by concussion of the spine of the 11th dorsal vertebra. The continuous lines represent the area of dullness before, and the interrupted lines the area after eliciting the liver reflex of dilatation. The liver in the mammary line measured 12 cm. and was increased to 16 cm.

PATHOLOGIC PHYSIOLOGY.

Circulatory Disturbances.—During digestion there is a physiologic congestion of the liver, but in persons who eat and drink to excess, this congestion may become pathologic and may even conduce to organic change. The fullness or distress in the right hypochondrium, to which reference is frequently made by dyspeptics, may be caused as Osler suggests, by hyperemia of the liver. The amount of blood contained in the liver is equivalent to one-fourth the amount

of blood contained in the body. During digestion this amount is very much increased, hence the drowsiness after eating, especially in dyspeptics, the result of brain-anemia from portal congestion and the cold extremities and chilly sensations. Hyperemia of the organs has been noted in suppression of the menses. Passive congestion is frequent in all conditions leading to venous stasis in the right ventricle of the heart, and is associated with swelling of the organ.

HEPATIC TOXEMIA.—Any hepatic disease may be associated with a variety of toxic symptoms connected with the nervous system.

In the norm, the poisonous substances in the intestinal canal are either not absorbed or, if they are, they are made innocuous and rapidly excreted. Auto-protection of the organism against self-poisoning is achieved by organs which either arrest or transform the poisons or eliminate them.

The *organs of defense* practically represent the bodily resistance. This, equationally expressed for germ-infection, is applicable to auto-poisoning, *viz.:*

$$D = \frac{PTA}{R}$$

D, the disease, equals P, the poison, multiplied by T, its toxicity, multiplied by A, its amount, the product being R, the resistance of the individual attacked. The liver is unquestionably the chief organ of defense. It converts the poisons into non-toxic and assimilable substances, filters them, and excretes them in the bile. When the liver-function becomes insufficient, the poisons destined for destruction enter the blood, and the clinical picture of hepatic toxemia results. If the liver is excluded from the general circulation by connecting the portal vein with the inferior vena cava, nervous manifestations and even death may follow the ingestion of meat. The condition known as *autointoxication* is, practically speaking, an hepatic toxemia.

Intestinal Autointoxication

Intestinal autointoxication, as we now comprehend it, may be briefly summarized as follows: During digestion, a number of poisons or enterotoxins are manufactured as a result of putrefaction of albuminoid food in the intestines. These enterotoxins attain the liver by way of the entero-hepatic circulation where they are made innocuous. From the liver they pass into the general circulation and are excreted in the urine. If albuminoid putrefaction is excessive, or if the liver and kidneys (notably the former), prove inadequate in either neutralizing or excreting the poisons, autointoxication ensues. Intoxication is expressed by a motley group of symptoms, which often parade under the equivocal designation, neurasthenia. Now, this conception of intestinal autointoxication is only partially correct. While the usual enterotoxins are bacterial products, there are also poisonous albumoses, *i. e.*, intermediate products manufactured in the digestion of albuminous foodstuffs. It is well known that when peptones and albumoses (normal products of digestion) are injected directly into the blood, they are poisonous and even fatal in their effects. Falloise has recently had an excellent opportunity of studying this subject in a patient with a fistula of the small intestine. He concludes that albuminoid-putrefaction is not the only process concerned in autointoxication, and that an aqueous extract of the contents of the small intestine is infinitely more toxic than an extract made from the contents of the large intestine. Hence, if we accept the prevailing opinion that putrefaction of the albuminous molecule is limited in the norm to the large intestine, factors other than putrefaction of the albuminous molecule must be concerned in intestinal autointoxication.

Contrary to current belief, I have found that, in those suffering from self-poisoning, diarrhœa, or at any rate,

looseness of the bowels prevails rather than constipation, and it appears as if this were a compensatory attempt on the part of the organism to rid itself of noxious products. Strassburger has shown that retarded bowel-action rather indicates diminished products of decomposition which normally stimulate the action of the intestines. If one were guided in the diagnosis of autointoxication by the statements of the patient, the condition would rarely be recognized. The fact is, the patients infrequently complain of symptoms of indigestion. It is only in aggravated cases that one encounters the conventional symptoms of dyspepsia. In most instances, nervous symptoms precede the local signs of indigestion.

Another supposed classical symptom of the affection is indicanuria; yet my experience shows that it is comparatively infrequent.

If one electrode of a sinusoidal current is placed over the sacrum and the other over the spines of the first three lumbar vertebræ, or, if the spines in question are concussed, one evokes the liver reflex of contraction. Either manœuver will promote the excretion of indican in the urine and its presence in the urine may be demonstrated after a single séance lasting fifteen minutes, even though previously absent. Naturally the urine must be voided before and after the application of the current and the specimens compared after examination is made for indican. For the examination of the latter I prefer the simple test recommended by Porter:

> Add in a test-tube equal quantities of urine and chemically pure hydrochloric acid. To this mixture add three drops of a one-half per cent solution of potassium permanganate. If indican is present in the urine there will be formed a purplish cloud in the fluid in the test-tube. Then add a few drops of chloroform then one drop

more of the potash solution and a few drops more of chloroform and shake vigorously. The deep-blue color resulting is due to precipitation of indican by chloroform and the amount and intensity of the precipitated indican determine the extent of the putrefactive changes going on in the alimentary tract.

SPLANCHNIC NEURASTHENIA.—In his book on this subject, the author has described a condition dependent on intraabdominal venous congestion superinduced by insufficiency of the splanchnic vaso-motor mechanism, and that the neurasthenic symptoms resulting therefrom may be corrected by relief of the congestion and by manœuvers which will increase the efficiency of the liver as an organ of defense. The fact is, splanchnic neurasthenia is intimately associated with autointoxication. When this venous congestion exists it interferes with a proper supply of arterial blood, and in consequence, the tissues and organs are bathed in pools of stagnant blood—they are practically asphyxiated. Again, the impeded circulation cannot remove the toxic products of digestion, and instead of the latter being at once conveyed to organs of elimination like the kidneys, they are arrested or transformed by organs like the liver, which soon prove inadequate to discharge their anti-toxic function; then we have the creation of symptoms which belong to the category of self-poisoning.

TREATMENT.

CIRCULATORY DISTURBANCES.—Every condition conducing to a stagnation of blood in the right heart is eventually followed by passive congestion of the liver. Merklen and Heitz have shown that coincident with the elicitation of the heart reflex, there is a reduction in the size of the liver (Fig. 58). Here, the heart momentarily awakens from its lethargy and by pumping an augmented quantity of blood

into the circulation temporarily reduces the congestion of the liver.

Many Anglo-Indian physicians directly aspirate eighteen or more ounces of blood directly from the liver and it is claimed that excellent results ensue from this hepato-phlebotomy. This method was suggested by observing the reduction in the volume of the liver after bleeding from piles.

Now, in many instances, one may regard congestion of the liver as a process of compensation, the liver acting as a reservoir for the redundant blood which correspondingly reduces the work of the heart.

By enlarging the volume of the liver by concussion of the spine of the 11th dorsal vertebra, the patient may be bled into his own vessels for, even in the norm, this organ contains approximately one-fourth of the amount of blood in the body.

In other instances, the organ may be depleted by exciting the liver reflex of contraction by sinusoidalization or concussion of the spinous processes of the first three lumbar vertebræ.

INTESTINAL AUTOINTOXICATION.—Food as a factor in the treatment of autointoxication is a much-abused commodity. Someone has observed that the ultimate trend of the physician was to prove that even food was poisonous and what has been suggested as a facetious prognostication, appears to have been endowed with reality, when one seriously contemplates the endeavors of dietetic revolutionists. Many dietetic vagaries are as consistent as the perfervid plea of the poet Shelley, who wanted us to become vegetarians and marry our sisters. By opposing alimentary insufficiency we possess a formidable weapon in immunizing the tissues against interminable dietetic insults. One must not forget that there is such a condition as "indigestion toxemia," due either to an excessive production of poisons

or to enfeeblement of the defenses. Thus there is an hepatic as well as a gastric and intestinal dyspepsia and the liver dare not be ignored even in the treatment of an ailment so plebeian as dyspepsia.

Intestinal asepsis is, in my experience, a purely theoretic conception which is rarely realized in practice. Intestinal antisepsis is difficult, if not impossible, for the following reasons: 1. An antiseptic strong enough to destroy germs is equally destructive to the intestinal mucosa. 2. Germicides will destroy the innocent germs which are concerned in digestion. 3. Germicides are rapidly absorbed or are made chemically inert. Recourse is also had to purgatives, but they often accentuate the symptoms of autointoxication because they concentrate the poisons already absorbed and remove the intestinal epithelium and mucus which practically act as barriers against the absorption of enterotoxins. We have discarded the swab in infectious diseases of the throat, for the reason that it mechanically injures the membrane of the throat and thus opens up new portals of infection. In this sense, the purgative is essentially an intestinal swab.

Intestinal autointoxication is a misnomer; the term of qualification refers only to the site where the poisons are manufactured.

The offending viscus in autointoxication is usually the liver and, if this organ is made equal to the task of destroying the poisons, the subject of self-poisoning would be simplified.

In autointoxication the liver is congested, enlarged and extremely sensitive to pressure; in fact, when the latter signs are present in the absence of organic disease, we are in the possession of the most positive evidence of hepatic inadequacy. Reference has already been made to the increased excretion of indican following the elicitation of the liver reflex of contraction (page 336) and the manœuver for

exciting the latter is the method employed by the author in correcting hepatic inadequacy in autointoxication. To best elicit the reflex in question sinusoidalization or concussion of the spines of the first three lumbar vertebræ is executed daily.

The results even after a single treatment is evident; the liver is reduced in volume and palpation shows diminished tenderness.

It would be manifestly inconsistent were the author to contend that the method suggested is curative to the exclusion of other methods of treatment. On the contrary, he is more disposed to say that concussion or sinusoidalization of the lumbar spines is more effectual as an individual method of treatment.

Excessive albuminous food, that is to say, a diet containing a large quantity of meats and eggs, augments intestinal putrefaction, and even though the organs of defense are relatively normal, they are incapable of performing their functions when an increased burden is thrust upon them.

It will be necessary for us to briefly consider other methods of treatment in autointoxication. Some contend that if indican can be detected in the urine, even by a feeble reaction, it is an indication that it is excreted in excessive quantity. Indican in the urine (*indicanuria*) suggests bacterial putrefaction of the proteid substances in the intestines, for in perfect digestion of the proteids, it cannot be detected in the urine.

Intestinal putrefaction as already suggested results from the action of proteolytic bacilli on albuminous food and the primary indication in treatment is to modify the culture medium of the intestine so as to render it inimical to the germs in question.

The best and most certain method of treatment is by means of an antiputrid régime.

It has been suggested that a sterile régime will destroy the virulence of the bacterial flora of the intestine, but observations show that sterile food will diminish but does not completely inhibit intestinal putrefaction.

An aseptic régime is best attained by the avoidance of crude vegetables and fruits, for no matter how thoroughly they are washed they still remain contaminated.

The cooking of foods will diminish the danger of infection by destroying bacterial growths and larger parasites (tapeworms and trichinæ). The cooking of vegetable foods breaks up the starch grains, bursting the cellulose and thus permitting the digestive fluids to come into immediate contact with the granulose.

ANTIPUTRID RÉGIME.—As before remarked, this is the most satisfactory means of antagonizing intestinal putrefaction. The putrescent aliments are the proteids and if the latter could be completely eliminated, there would be no putrefaction, and consequently, no intestinal autointoxication. All investigations show that intestinal putrefaction augments parallel with the quantity of albuminous foodstuffs. We know, however, that the proteids or albuminous foodstuffs are true tissue-builders and repairers and consequently cannot be eliminated without compromising nutrition. We know, furthermore, that the proteid requirements of the individual have been exaggerated and that the experiments of Professor Chittenden show that men can maintain health and muscular efficiency for long periods on about half the amount of proteid which is usually consumed. It would be difficult now to maintain, as did Herbert Spencer, that the consumers of meat showed superior physical strength to the consumers of rice, which would be equivalent to saying the Russians demonstrated more physical endurance than the Japanese. One may conclude conservatively that we ordinarily consume more proteid food than is necessary and that ingested in excess, it is either conserved for future uses of the economy, or remaining undigested, it must be reduced by bacterial digestion. Instead of the individual requiring one hundred and twenty grams daily of proteid according to the diet table of Moleschott, or one hundred grams according to the diet table of Ranke,

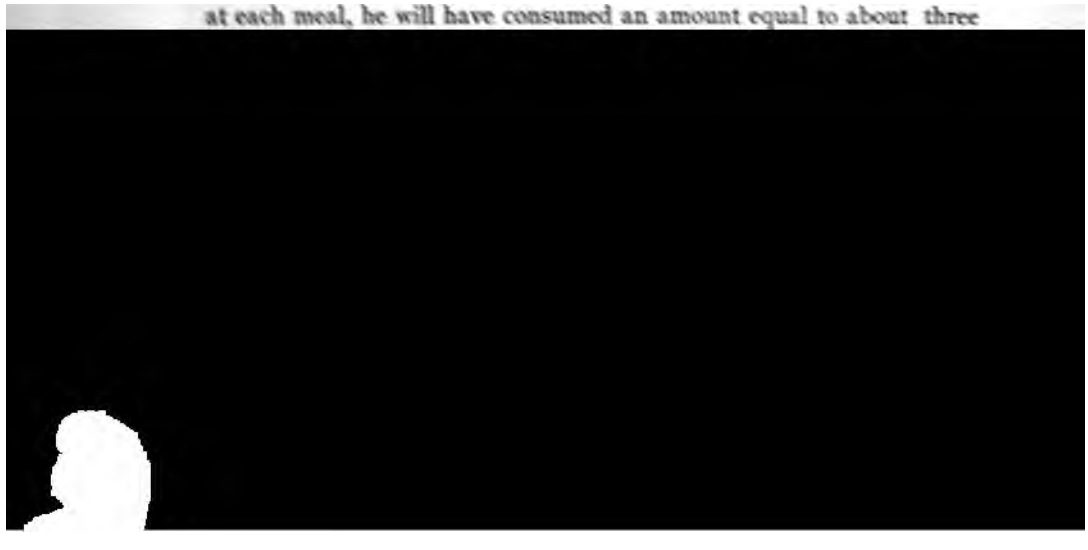
the amount of proteid may be reduced considerably without prejudice to the individual.

If an individual were desirous of taking his daily supply (100 grams) of proteid in the form of meat, it would be necessary for him to consume a little more than one pound (500 grams) of meat. It was at one time supposed that fats exercised no influence on intestinal putrefaction, but more recent experiments have demonstrated that this observation is faulty and that fats do increase intestinal putrefaction.

The lacto-farinaceous diet of Combe is the antiputrid régime *par excellence* in the treatment of autointestinal intoxication; it acts not by any destructive influence on the intestinal flora, but seeks only to modify the soil in which the microbes live.

Milk.—Of all aliments, milk is probably the most resistant to putrefaction, and it has been found by Winternitz that if a certain quantity of milk is given with a meat diet, it will diminish the production of enterotoxins. Milk owes its antiputrid properties to the lactose which it contains and which, under the influence of the aerobic bacilli of the small intestine (*coli* and *lactis aerogenes*) is decomposed into succinic and lactic acids. These acids inhibit the action of the proteolytic bacilli in the large intestine from acting on the albuminous foodstuffs. Cow's milk contains about 3.5 per cent of proteids (chiefly caseinogen) against 12.2 per cent in the white of eggs and about 20 per cent in meats.

I find that some individuals cannot tolerate even small quantities of milk (raw or boiled) without causing diarrhœa. In such instances, I employ lactose (milk sugar). Cow's milk contains 5 per cent of lactose; hence if the individual will take about 400 grains of lactose at each meal, he will have consumed an amount equal to about three



4. Koumiss.
5. Kefir.
6. Fresh cheese (*fromage à la crème*).

Buttermilk, owing to its small amount of fat and casein (chief proteid of milk), is a very desirable product in autointoxication, inasmuch as one knows that these substances favor putrefaction. Again, the presence of lactic acid and lactose enables the latter to produce lactic acid *in statu nascenti*. Condensed buttermilk may be obtained in flasks containing 330 grams, and to prepare the buttermilk one mixes the contents of one flask with 660 grams of a decoction of cereals, thus obtaining one liter of porridge (*potage au babeurre*).

The composition of Koumiss varies with its age, containing on the first day about .96 per cent of lactic acid and about one per cent on the twenty-first day after its preparation. It contains nearly the same percentage of alcohol as beer. Koumiss is an agreeable and easily digestible preparation.

Fresh soft cheese contains considerable assimilable casein and therefore subserves a useful purpose in proteid nutrition and it has all the advantages and none of the disadvantages of milk. Thus the soft cheese known as *petit suisse* contains the following: Albumin 4 per cent; casein, 24 per cent; lactose, 2 per cent; and lactic acid, .60 per cent.

FARINACEOUS ALIMENTS.—Combe* formulates the following conclusions:

1. The carbohydrates, or sugary foods, prevent proteid putrefaction in the intestine.

2. That in natural digestion, the farinaceous foods (rice, farina of cereals and their derivatives) surpass all other carbohydrates because they are less easily absorbed and they penetrate more profoundly into the intestine and only gradually furnish lactic and succinic acids.

3. That the maximum quantity of farinaceous food must be given with each repast and, if possible, to carry out this cramming process, this food must be given five or six times a day.

*L'Auto-Intoxication Intestinale, Paris, 1907. There is an English translation of this book published by the Rebman Company.

4. Interdict as far as possible, all albuminous foodstuffs but choose among them the least putrescent (like eggs) and when they are used, combat their action by an excess of farinaceous food.

5. In the ordinary forms of autointoxication, milk mixed with farinaceous food is better supported than milk alone.

6. Avoid fats, which augment putrefaction, and choose butter in preference.

If one is desirous of carrying out, if only for test purposes, an antiputrid régime, one may select the following:

1. Milk, or lactose as a substitute.
2. Cooked vegetables, preferably as purées.
3. Preserved or cooked fruits.
4. Weak coffee, tea or cocoa.
5. Toast with little butter.
6. Farinaceous foods prepared as puddings, or otherwise. These must be consumed in abundance.
7. Buttermilk or Koumiss.
8. Fresh cream cheese.

Later, if the condition of the patient is ameliorated, easily digestible albuminous foodstuffs like eggs, ham and cold meat, together with fresh fruits (preferably bananas), may be permitted.

ANTAGONISTIC MICROBES.—Ever since Metchnikoff directed attention to the fact that sour milk microbes are antagonistic to the microbes of putrefaction, it is quite the custom in France to employ the former in the treatment of autointoxication. The chief characteristic of the intestinal flora of the autointoxicated, is the marked diminution of the saccharolytic aerobic bacilli and the preponderance of the proteolytic anaerobic varieties. To modify the foregoing condition a vegetarian or lacto-vegetarian or lacto-farinaceous diet is indicated on account of the small quantity of proteid matter which it contains and the lactic acid which it produces. Another method is to feed the subject with lactic acid ferments or microbes which are innocuous but exert an inhibitory influence on the microbes of putrefaction. There are now several lactic acid culture mediums on the market, but many of them seem to lose their therapeutic action when prepared in the form of tablets or globules.

Unquestionably, the *liquid lactobacilline*, as it is called, is the most efficient. It may be taken in milk or water directly from the small bottles in which it is sold, and one bottle (containing about half a teaspoonful) a day is the average dose. During the first few days, digestive disorders may follow its use but soon constipation ceases, the stools lose their putrid odor, the breath sweetens and the tongue becomes cleaner. The signs of autointoxication disappear slowly but surely. To make these good results permanent, the treatment is continued on an average for two and a half months. The ferment is ordinarily employed in association with the diet, although some writers claim that nearly all the effects can be secured from the ferment alone. According to Cohendy, it takes about six days before the lactic acid microbes change the intestinal flora. If diarrhœa is caused by intestinal putrefaction, it is said to be arrested by this bacterio-therapeutic method.

If lactic acid culture mediums cannot be obtained, then buttermilk or koumiss may be used. Holt suggests the following formula for the domestic manufacture of koumiss: one quart of fresh milk, one-half ounce of sugar, two ounces of water and a fresh piece of yeast cake (one-half inch square), are put in wired bottles and kept at a temperature between 60 and 70 degrees F. for one week. The bottles are shaken five or six times a day. They are then put on ice and kept ready for use.

This bacterio-therapeutic method may have to be employed to the exclusion of the laco-farinaceous diet for there are some individuals who suffer from dyspeptic symptoms if the latter is pursued too vigorously.

SPLANCHNIC NEURASTHENIA. — The chief abdominal symptoms of this affection are: abdominal sensitiveness, tenderness and enlargement of the liver, and gaseous accumulations in the bowels. The dominant symptoms of the affection are resident in the nervous system. Depression, or as it is popularly called, an attack of "the blues," is scientifically speaking, an exacerbation of splanchnic neurasthenia and coincident with the depression, there is hepatic enlargement and tenderness. Eliciting the liver reflex of contraction will

at once dissipate partially or completely the liver tenderness and enlargement, and will ameliorate the condition of the patient. Splanchnic neurasthenics find that their symptoms are accentuated after meals and this may be accounted for by the augmented amount of blood in the liver at this particular time.

The factors which contribute to the development of splanchnic neurasthenia are essentially nerve-force lacking

FIG. 89.—Illustrating the cardio-splanchnic phenomenon. The shaded area indicates the dullness obtained after vigorous compression of the abdomen. The contiguous area is the superficial area of cardiac dullness.

in the muscles of the abdomen and in the nervous mechanism which regulates the supply of blood in the abdominal vessels.

The former factor indicates reduced intraabdominal tension, for the greater the latter, the less blood will be contained in the abdominal vessels. It is for this reason, that one finds in splanchnic neurasthenia the objective signs of reduced intraabdominal tension (page 145). There is

another sign which the author has called the *cardio-splanchnic phenomenon*[67] (Fig. 89). There is a tendency of the blood to accumulate in the splanchnic area, with consequent syncope.

Like the generality of veins, the great splanchnic veins are very susceptible to pressure, and the amount of blood within them is greatly influenced by the pressure of the abdominal walls. Mere pressure of the latter suffices to squeeze out of them a large quantity of blood. More blood accumulates in the splanchnic veins in the erect than in the recumbent posture, and it is not an uncommon observation for syncope to occur in bedridden patients who are suddenly constrained to get out of bed. The removal of stays in women often induces a feeling of faintness, and the same symptom may occur when a large quantity of ascitic fluid is removed and, in susceptible subjects, when the bladder is emptied or feces discharged.

Hill has shown that in consequence of some failure, the blood gravitates into the splanchnic veins from the right heart, and that pressure upon the abdomen will send back the blood from these veins to the right heart, and thus re-establish the circulation.

If the lower sternal region, *i. e.*, the part of the sternum contiguous to the heart, is first percussed, the sound elicited is one of resonance or hyperresonance; if now, one makes vigorous compression of the abdomen, percussion again shows that the region in question has become dull or even flat. This is the cardio-splanchnic phenomenon and is present even in the norm, but when there is intraabdominal venous congestion as in splanchnic neurasthenia, this phenomenon is much exaggerated and the area of dullness is more diffused.

By percussing the lower end of the sternum in the erect

posture, one obtains a resonance, but when the patient assumes the recumbent posture, a dullness supplants the resonance. This is the attitudinal cardio-splanchnic phenomenon. It is present in health but absent when the splanchnic vaso-motor mechanism is defective.

The splanchnic circulation is partly venous and partly arterial, and consists of the portal vein and its branches and the arterial branches of the celiac axis. When a person stands, the splanchnic vaso-motor mechanism causes a constriction of the splanchnic vessels and the blood-pressure rises, but, if ineffective, it fails to rise or falls. Now, in splanchnic neurasthenia, the splanchnic vaso-motor mechanism is exhausted and it is inadequate to prevent a flow of blood to the splanchnic vessels. The following test demonstrates an adequate automatism of the vaso-motor mechanism:

	PULSE-RATE.	SYSTOLIC BLOOD-PRESSURE.
Lying.....	60	118
Standing.....	60	130
Difference.....	0	—12 mm.

In the following test, the vaso-motor mechanism is insufficient:

	PULSE-RATE.	SYSTOLIC BLOOD-PRESSURE.
Lying.....	60	104
Standing.....	100	90

Respecting the latter method. The dorsal region of the spinal cord represents the origin of the majority of vaso-constrictors in the body. The splanchnic vaso-motor mechanism which controls the vessels of the abdominal viscera consists of the splanchnic nerves which are composed of fibers issuing from the cord in the 5th to the 12th dorsal nerves, inclusive. Reference to Fig. 10, shows that the dorsal nerves in question correspond to the spines of the 2nd to the 8th dorsal vertebræ inclusive.

Now, if the spines in question are sinusoidalized, or better still, concussed, the cardio-splanchnic phenomenon (page 346) is at once brought into evidence. In other words, the blood is expressed from the abdominal vessels to the right heart.

Concussion then, of the 2nd to the 8th dorsal spines, inclusive, is a very active means of augmenting the tone of the splanchnic vaso-motor mechanism and constitutes a very efficient method of treatment in splanchnic neurasthenia and in all forms of intraabdominal congestion even without nervous symptoms.

In *Glénard's disease*, or enteroptosis, the prolapse of one or more abdominal organs is associated with neurasthenic symptoms and the wearing of an abdominal supporter affords much relief to the wearer. The relief thus attained is not due wholly to reposition of the organs, as is instanced in the observations of Bial. The latter applied transparent bandages to cases of gastroptosis and transilluminated the stomachs before and after the application of the bandages. No change in the position of the stomach could be noted, and it is therefore most likely that abdominal supporters act chiefly by compression of the viscera, which, in turn, squeeze the blood out of the turgid abdominal veins.

The author has treated many cases of Glénard's disease

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based on the principle that the symptoms are often dependent on a faulty vaso-motor mechanism and by increasing the tone of the latter, by sinusoidalization or concussion of the spines of the 2nd to the 8th dorsal vertebræ, one may ameliorate the symptoms.

CHAPTER X.

MISCELLANEOUS REFLEXES.

THE SPLEEN—REFLEXES OF THE SPLEEN—SPLENIC REFLEXES IN TREATMENT—UTERUS REFLEX—DYSMENORRHEA—THE BLADDER REFLEX—THE KIDNEY REFLEXES—NERVOUS SYMPTOMS; PARALYSIS, CONTRACTURES, ATAXIA.

THE SPLEEN.

THIS enigmatical organ of the physiologist, like the other viscera, is not constant in size; on the contrary, the spleen contracts and expands synchronously with the periods of digestion. It attains its maximum dimensions at about the fifth hour after a meal and then slowly returns to its previous size. According to Schaefer, motor nerve-fibers are contained in the splanchnic nerves which, when stimulated, cause either a contraction or a dilatation of the spleen. No doubt the contraction and dilatation of the organ are dependent on its intrinsic musculature, that is, the plain muscle tissue existing in the capsule and the trabeculæ. It has been found that when the spleen contracts the liver becomes enlarged. It is the popular belief that the spleen is influenced by the nervous system and Botkin found that depressing emotions increased its size and exhilarating ideas diminished it.

The latter observer also noted that the application of the induced current to the skin over the spleen in a case of leukemia caused the organ to contract and that each stimulation was followed by an increase in the number of colorless corpuscles in the blood and the condition of the patient improved. We will note presently that the spleen may be made to contract even in the norm.

In fevers there is an acute swelling of the spleen and a chronic enlargement of the viscus is observed in malaria and leukemia. Enlargement of the organ (*splenomegaly*) is associated with other diseases of the blood, notably pernicious anemia, Hodgkin's disease, congenital syphilis and Banti's disease.

REFLEXES OF THE SPLEEN.

Like the other viscera, two reflexes of the spleen may be elicited, *viz.*, that of contraction and dilatation.

For diagnostic purposes these reflexes, like other visceral reflexes, are obtained by several concussion blows with the hammer on a pleximeter while the latter is resting on definite vertebral spines. The *splenic reflex of contraction* is elicited by concussing in succession the spines of the first three lumbar vertebræ, whereas the *splenic reflex of dilatation* is obtained by concussing the spine of the 11th dorsal vertebra. The spleen may be brought into evidence by this reflex even when percussion shows no area of splenic dullness.

The contraction and dilatation of the organ are evidenced by percussion and to aid the latter, the vibrations of the spine and sternum may be suppressed after the manner detailed on page 80.

The results of the concussional manœuvers just cited are shown in Fig. 90.

THE SPLENIC REFLEX IN TREATMENT.

Only the splenic reflex of contraction has thus far been employed by the author for therapeutic purposes, although he believes that careful hematologic examinations after eliciting both reflexes, may shed some light on the functions of the spleen which have thus far baffled physiological investigations.

FIG. 90.—Illustrating the splenic reflexes. The continuous line represents the area of dullness of the spleen before vertebral manipulation. The interrupted line within the continuous line represents the splenic reflex of contraction whereas the interrupted line outside of the continuous line represents the splenic reflex of dilatation. The latter reflex measures 9 cm. and the reflex of contraction only 3 cm. in the anterior axillary line.

The fact that the spleen is endowed with contractility has engendered the employment of therapeutic measures to the splenic region like electricity and heat and cold with the object of reducing the volume of the organ. Such measures are, however, only illusory, insomuch as any irritation of the skin in the region of the spleen produces a dilatation of the lungs (lung reflex of dilatation, page 294) which, descending over the spleen, gives the erroneous impression that the spleen has contracted.

It was the erroneous observation of Adamo Moscucci that led the author to first discover the lung reflex of dilatation. Moscucci reported the cure of enlarged spleens in malaria by spraying ether over the splenic region. In attempting to confirm the observations of Moscucci, the author found that the ether acted as a cutaneous irritant and by dilating the lungs gave the impression that there was a reduction in the volume of the spleen.

The anatomic structure of the spleen suggests its function, *viz.*, a lymph-gland which acts as a receptaculum for foreign and noxious elements circulating in the blood. No doubt the leukocytes in the spleen assist by their phagocytic action in destroying the noxious elements which have been filtered by the organ. Weidenreich has shown that the splenic vein contains seventy times as many leukocytes as the splenic artery.

The spleen is a favorite repository for microorganisms and it has long been recognized as the habitat of the *plasmodium malariae*. Indeed, Laveran avers that the plasmodium here finds protection from destruction in the circulation.

The fact has been recognized that cutaneous irritants (douches, electricity, etc.) in the splenic region may precipitate a malarial paroxysm in latent malaria. Here it is assumed, that the therapeutic manœuvers in question

contract the spleen and thus dislodge mechanically into the circulation the plasmodia which have lodged in the organ. *Quinin* has a specific action on smooth muscle and contractions of the spleen, uterus and intestines have been observed.

Now, quinin in its action shows a specific toxicity to the organisms of malaria, yet even when the plasmodia cannot be demonstrated in the blood of the periphery, a single dose of quinin by contracting the spleen may force the plasmodia into the circulation and thus make their demonstration evident.

Samuel Hahnemann's homeopathic theory of *similia similibus curantur* was founded on this untoward effect of quinin. Hahnemann, at one time, had malaria, and suffered from no attack for many years, until one day he tried the effect of cinchona upon himself for experimental purposes. The ingestion of the drug was followed by a violent rigor and a well-marked attack of ague, and thus he argued: If cinchona is a remedy for ague, and if in me it has precipitated an attack of the disease, it must follow that a small dose of the drug which produces certain symptoms will cure the same symptoms when they are caused by the disease.

The author has shown that the splenic reflex of contraction may be elicited most effectually by concussion of the first three lumbar spines and he has utilized this reflex in the diagnosis and treatment of malaria. Thus, in *latent malaria*, he has precipitated a typic paroxysm (chill, fever and sweating) by such concussion. He has also demonstrated after the latter manœuver the presence of plasmodia in the blood, although absent previous to the concussion.

In the *treatment of malaria*, he employs concussion in connection with the use of quinin and, in this way, he has achieved excellent results.

Several cases of pernicious malaria and malarial cachexia

are recalled which resisted the action of quinin alone, but when the latter was used in combination with concussion, treatment was effective.

It may also be observed that although in these cases, months and even years may elapse before there is any reduction in the size of the spleen, concussion of the spines of the first three lumbar vertebræ will cause the ague-cake to disappear after several weeks treatment.

Puncture of the spleen has often been done with the object of aspirating the juice of the spleen to demonstrate in the latter, the plasmodia and typhoid bacilli. The latter are almost constantly found in the spleen. Splenic-puncture is by no means a harmless procedure and, for this reason, it has been abandoned by conservative clinicians.

Isolation of typhoid bacilli from the blood is a useful procedure in the diagnosis of *typhoid fever*, and the author suggests concussion of the lumbar spines to facilitate the demonstration of the bacilli in the blood. He has had, however, no proof to justify the suggestion.

The following cases are interesting:

I. A young man had symptoms suggesting the latent or ambulatory form of typhoid fever. The spines of the first three lumbar vertebræ were concussed during a séance lasting ten minutes. The following day, the typic symptoms of typhoid fever appeared and convalescence was not established until the fiftieth day.

One could, with reason, regard the development of the symptoms following concussion as a mere coincidence, yet a like observation in two other cases of a similar nature would seem to justify the conclusion that, in consequence of contraction of the spleen following the manœuver, typhoid bacilli were forced into the general circulation by contraction of the spleen.

II. A young lady had apyrexia for one month fol-

lowing typhoid fever. Her spleen was enlarged and she suffered pain (as often occurs from tension of the capsule of the spleen) in the region of the organ. An effort was made to reduce the volume of the organ by concussion of the spines of the first three lumbar vertebræ. After three treatments, she suffered a relapse lasting fifteen days and roseola, diarrhœa and a step-like temperature were prominent symptoms.

The conditions favoring a relapse in typhoid fever are unknown. A relapse is associated very often with some indiscretion in diet.

The author supposes that in these cases reinfection results from contraction of the spleen forcing the typhoid bacilli into the circulation. Indiscretions in diet are followed by an enlargement with subsequent contraction of the spleen. For this reason, the author suggests concussion as a therapeutic manœuver not only to prevent relapses but to hasten defervescence in typhoid fever.

This same therapeutic manœuver suggests itself in the treatment and diagnosis of other infectious diseases associated with an enlargement of the spleen.

It has been known for some time that enlargement of the spleen was associated with anemia and cachexia, and the condition was specified as splenic anemia or *splenomegalia cum anemia*, but Banti demonstrated that the splenomegaly was not secondary as in leukemia, but autochthonous and responsible for the symptomatic complex known as *Banti's disease.*

The author has successfully treated one case of the latter disease by elicitation of the splenic reflex of contraction after a number of séances of concussion of the spines of the three first lumbar vertebræ.

THE UTERUS REFLEX.

If one electrode from a sinusoidal current is applied over the sacrum and an interrupting electrode is fixed over the spines of any of the first three lumbar vertebræ, a distinct contraction of the uterine walls may be observed through a speculum. The author has had no experience with this reflex in treatment and is therefore unable to determine its practical value.

DYSMENORRHEA.

Painful menstruation is subdued in conventional practice by treatment of the cause and the use of some analgesic during the paroxysm of pain. The author has thus far examined about fifty patients who suffer from painful menstruation and has noted points of tenderness located either to the right or left side or both sides of one or more of the spines of the first four lumbar vertebræ. Firm pressure made with the end of the thumb (page 170) over one or more sensitive areas will abolish the pain for several hours or during the entire period of the menstruation. The latter excellent result, however, is infrequently achieved, and it may be necessary to repeat the manœuver several times during the menstrual period. The areas of tenderness may be marked with a stick of nitrate of silver and some member of the family may be taught the method of making pressure. In other instances the areas of tenderness may be frozen (page 172) and the effect may last during the entire menstrual period. Freezing, if effective, is decidedly more lasting in its results than pressure.

THE BLADDER REFLEX.

The author has investigated this reflex in association with Dr. Henry Meyer of San Francisco, an acknowledged

expert with the cystoscope. With one electrode over the sacrum and the interrupting electrode at the spine of the 5th lumbar vertebra, a decided contraction of the wall of the bladder and its sphincter can be observed with the cystoscope. The sinusoidal current was used and contraction of the abdominal wall was excluded. No doubt there is a distinct vertebral site for contraction of the sphincter and for the detrusor vesicæ. However, the reflex in question is merely cited as a suggestion to cystoscopists for its elaboration. The bladder reflex may be utilized in atonic conditions of the musculature of the bladder.

THE KIDNEY REFLEXES.

PERCUSSION OF THE KIDNEYS.

Among the cognate branches of medicine, physical diagnosis is the least progressive. It still bears the imprint of tradition and any attempt to improve upon the methods of the founders—Auenbrugger, Lænnec, Skoda and others—is viewed as an act of sacrilege. It is suggested in the text-books, that owing to the anatomic position of the kidneys (Fig. 11), their boundaries cannot be limited by percussion and that the thick layers of muscles behind yield a dullness which an organ as thin as the kidney could not increase. It may be affirmed, however, that, as a rule (excluding non-resonant impacted feces in the colon), one may determine the lower and a portion of the outer border of each kidney by contrasting its dullness with the tympanicity of the ascending and descending colon which lie anterior to each organ. If it is a question of tympanicity which obscures the dullness of the kidney, this objectionable feature may be obviated by suppressing the vibrations of the spine by having an assistant fix his hand on the latter during percussion (*vide* vibro-suppression). If it is a question of

dullness of the spinal muscles, have the patient lean far backward to relax the muscles during percussion. Having defined the kidneys by percussion, concuss in succession with the hammer and pleximeter (Fig. 2), the 6th, 7th and 8th dorsal spines; percussion executed at once now demon-

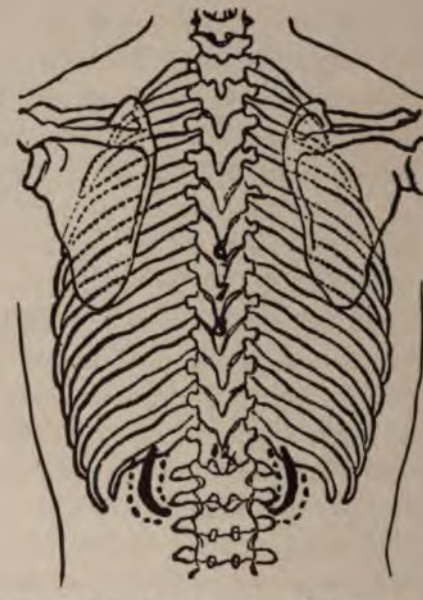


FIG. 91.—Kidney reflexes of contraction and dilatation. The continuous line represents the area of kidney-dullness and the dotted lines within and without the reflexes of contraction and dilatation respectively.

strates an increase in the area of renal dullness which is the *kidney reflex of dilatation*. Concussion of the 12th dorsal vertebral spine causes a decrease in the area of renal dullness, which is the *kidney reflex of contraction* (Fig. 91). The latter, like other visceral reflexes, are of limited duration. It is known that by means of the oncometer, that the kidney, like the spleen, shows variations in volume. The real volume of the living kidney depends upon the distension of

its structural elements, upon the quantity of lymph and specially upon the amount of blood in its blood-vessels. When the latter dilate the kidney increases in size and when the vessels contract, the kindey diminishes in volume.

THE KIDNEY REFLEXES IN DIAGNOSIS AND TREATMENT.

Insomuch as the kidney reflexes have only recently been discovered by the author, anything he may say concerning their value in diagnosis and treatment can only be theoretic. One could assume that backache due to distension of the capsule of the kidney could be relieved by diminishing the volume of the organ by concussing the 12th dorsal spine with the hammer. Pain due to the presence of a renal calculus would be intensified by the same manœuver.

A dull area supposed to be the kidney would increase with elicitation of the kidney reflex of dilatation and would decrease by elicitation of the counter kidney reflex. Surgery has been invoked in the treatment of chronic nephritis.

Thus, some surgeons have resorted to puncture (renipuncture) of the kidney and others to incision of the capsule, thus assuming that the fundamental condition demanding relief was tension of the organ. Others assume that nephropexy relieves the condition by establishing vascular adhesions which carry an additional supply of blood.

The author has treated only one case of parenchymatous nephritis by concussion, but the results are nevertheless interesting. Acting upon the theory that a better blood-supply was essential, the treatment consisted of daily séances of concussion to elicit the kidney reflex of dilatation. After about seven treatments, the albumin increased in the urine, the blood-pressure became higher and edema of the extremities developed. Concussion of the spine of the 12th dorsal vertebra was then executed to elicit the reflex of

contraction and thus diminish the volume of the kidney. After a few treatments the edema rapidly disappeared, the blood-pressure sank to 165 mm. (from 210 mm.) but the albumin continued in the urine (at this time of writing), although slightly diminished in percentage.

In interstitial nephritis, increasing the volume of the kidney (by eliciting the kidney reflex of dilatation) would theoretically be indicated.

NERVOUS SYMPTOMS.

PARALYSIS.

Reference has already been made on page 11 to the *spinal muscular reflexes.*

In electrotherapeutics, the average neurologist concerns himself with the employment of only the Galvanic and Faradic currents. He has little faith in influencing the site of the lesion and contents himself with stimulation of the paralyzed muscles, hoping that such irritation may act indirectly at the site of the lesion.

Reference has already been made to the action of the sinusoidal current on page 11, in provoking contraction of the muscles by central stimulation. Other currents are not effective in achieving this object. By vertebral stimulation, one may provoke contractions of muscles which are not possible by the conventional method of peripheral application. The contractions of the muscles are bilateral, and the latter fact is of great importance in comparing the contractions on both sides of the body. The illustration on page 13 will aid the physician in contracting definite groups of muscles. Thus, as an example, one may cite the following: Assuming that the patient cannot extend the leg upon the thigh. Here the quadriceps femoris is implicated. Reference to Fig. 14 shows that the cell-bodies of origin of the quadriceps femoris are located in the 2nd and 3rd lumbar seg-

ments of the cord and that these segments correspond to the 10th dorsal spinous process (page 14 and Fig. 10). To stimulate the muscle in question the exciting pole, *i. e.*, the interrupting electrode of the sinusoidal current is fixed at the spinous process of the 10th dorsal vertebra, whereas the indifferent electrode is placed over the sacrum.

CONTRACTURES.

When definite groups of muscles are weakened or paralyzed, the antagonistic muscles not encountering the normal resistance to their action, move the limb in an abnormal position and hold it there. The latter is a passive contracture. If a limb is fixed in an abnormal position by a tonic contraction of certain groups of muscles, one is dealing with an active or spastic contracture. Concerning the reciprocal action of antagonistic muscles, the researches of Sherrington show in brief that the inhibition of the tonus of a voluntary muscle may be brought about by the excitation of its antagonist. To overcome contractures, vertebral sinusoidalization is very effective in stimulating groups of muscles antagonistic to the shortened muscles after the method of segmental localization just described under paralysis.*

ATAXIA.

The attention of the reader is directed to the remarks on page 28, concerning the knee-jerk in locomotor ataxia. It is generally conceded that in the latter affection the ataxia is caused either by a loss or disturbance of the afferent impulses from the deep tissues, joints and muscles. In addition there is a disturbance of the muscular sense and hypotonia (*q. v.*) is present.

Attention has already been directed on page 165 to the re-education of co-ordinated movements in locomotor ataxia

*For further reference to this method of treatment, *vide* footnote on page 147.

which has yielded excellent results. The re-education method is based on the observation that if an ataxic individual repeats a movement several times in succession, the ataxia in such a movement becomes less evident. The tabetic patient has an erroneous idea of the movement which he is executing, with the consequence that the movement is faulty. The "movement-memories" which he had in health no longer subserve his purpose and a new series of "movement-memories" must be acquired corresponding to the impressions which are received through neurons which are still intact.

The author has shown that whereas the afferent paths are compromised, the descending or motor paths may not be impaired. Taking advantage of the latter fact he effects re-education of the defective movements by vertebral sinusoidalization with results which prompt him to say supersede the conventional exercises in rapidity of action. The method, in brief, is to bring into action definite muscle-groups of the lower extremities by applying one large electrode to the region of the sacrum and the interrupting electrode over definite spinous processes (page 13). The author cautions against the employment of a strong sinusoidal current. The latter should only be sufficiently strong to provoke slight contractions of the muscles; otherwise, a hypertonicity of certain muscles ensues, resulting in muscle-bound extremities making locomotion even more difficult than before the use of the current in question. Not infrequently, the large electrode may be fixed in the lower dorsal region, and the interrupting electrode over definite spinous processes. One of my ataxic patients had difficulty in locomotion owing to abduction of the lower extremity. By bringing the *adductors* into play by vertebral sinusoidalization the difficulty was corrected. The relief of PAIN in locomotor ataxia may be attained by the methods suggested in chapter XI.

CHAPTER XI.

THE THERAPEUTICS AND DIAGNOSIS OF PAIN.

SEGMENTAL-ANALGESIA — CONCUSSION-ANALGESIA — SEGMENTAL-LOCALIZATION—THE TRIGEMINUS NERVE—SINUSOIDAL-ANALGESIA—SEGMENTAL-PSYCHROTHERAPY—SEGMENTAL-ANALGESIA OF THE VISCERA—SEGMENTAL-ANALGESIA IN DIAGNOSIS—PHYSIOLOGY OF SPONDYLOTHERAPEUTIC METHODS.—SPINAL NERVE-TRUNK ANALGESIA—CORTICAL SINUSOIDALIZATION.

THE pharmacotherapy of pain concerns itself with the use of drugs known as anodynes or analgesics which annihilate sensation either through the brain (opium and its derivatives) or by enfeebling the heart, which relieves the hyperemic pressure on the nerve-tissues.

LOCAL ANESTHESIA is effected by cocain and its substitutes. *Aconite* primarily causes local irritation followed by anesthesia, but it produces no inflammation of the part.

Among the aromatic series, *carbolic acid* is the most important local anesthetic. By applying a drop of the acid to the skin, one is able to puncture the latter without pain. Among the mechanic methods are: protracted tepid baths, freezing, cupping and counterirritation.

In the treatment of pain by methods other than drug-giving, it is customary to employ agents at the peripheral site of the pain, thus ignoring the "*law of eccentric projection*," viz., in stimulation of a nerve, irrespective upon which point of the course of the nerve it acts, the perception of a pain is transferred to the periphery. Pain perception results from an accumulation of individual stimulations in the gray substance of the spinal cord. Thus, in the employment of our peripheric methods, we usually disregard the true origin

of the pain. That the average physician ignores the central origin of pain may be exemplified by the following case:

> A middle-aged individual suffered for four years from a brachial neuritis. The pains were so violent that morphin was habitually used; in fact, his last physician instructed him how to use the hypodermic syringe. Ever since his trouble commenced he has traveled from city to city seeking relief. Every conceivable method known in physiotherapy was employed, but *always at the peripheral site of the pain.* An examination revealed a few points of vertebral tenderness at the exits of some of the spinal nerves, whereas others were developed as a result of manipulation of the peripheral areas of tenderness. The paravertebral area of vertebral tenderness was frozen most thoroughly and for the first time in four years the patient had a surcease of his pain for about eight hours. A second freezing gave relief for two days, and a few further freezings sufficed for a cure.*

SEGMENTAL-ANALGESIA.

Under this caption the author refers to the annihilation of pain in skin-areas and viscera related to different spinal-segments. Cutaneous and visceral analgesia may be achieved by the following methods:

1. Concussion.
2. Slow sinusoidal current.
3. Freezing.
4. Pressure (*vide* page 170).

Other remedial measures (such as the high frequency current, *rapid* sinusoidal current, Galvanic and Faradic

*All cases of neuritis are not equally amenable to such rapid results, and it may be necessary to freeze the sensitive peripheral nerves as a palliative and curative measure, insomuch as they may represent the site of a neuritic process and not as is usually the case, at the points of exit of the spinal nerves.

electricity, phototherapy, cupping and counterirritation) have been tried with the same object in view but without results.

CONCUSSION-ANALGESIA.

The fear of employing forcible concussion of the spinous processes and the use of ineffectual apparatus have deterred physicians from obtaining more definite and decided results from vibro-massage. Reference to the foregoing facts has already been made on page 178. Here, as elsewhere in this work, the results cited have been achieved by the pneumatic hammer, but any other apparatus yielding a series of strong percussion blows, will no doubt yield like results.

Preliminarily, the following facts are worthy of emphasis:

1. Concussion and sinusoidalization stimulate the motor component of a spinal-segment and subdue its sensory constituent.

2. The sensory component of a normal spinal-segment is less amenable to concussion, sinusoidalization and freezing than a hyperesthetic segment.

In other words, concussion, sinusoidalization and freezing show a more decided analgesic action on hyperesthetic viscera and peripheral areas than when the tissues in question are normal. In the employment of the foregoing methods, the analgesia is bilateral.

SEGMENTAL-LOCALIZATION.

Reference has already been made to this subject on page 30. Assuming that the patient has pain in one of the skin-areas (Fig. 15), it is not difficult to ascertain the relation which a given area bears to a spinous process by consulting Fig. 10.

Thus, a patient suffers from pain on the anterior surface of the toes (Fig. 15) involving the second sacral segment.

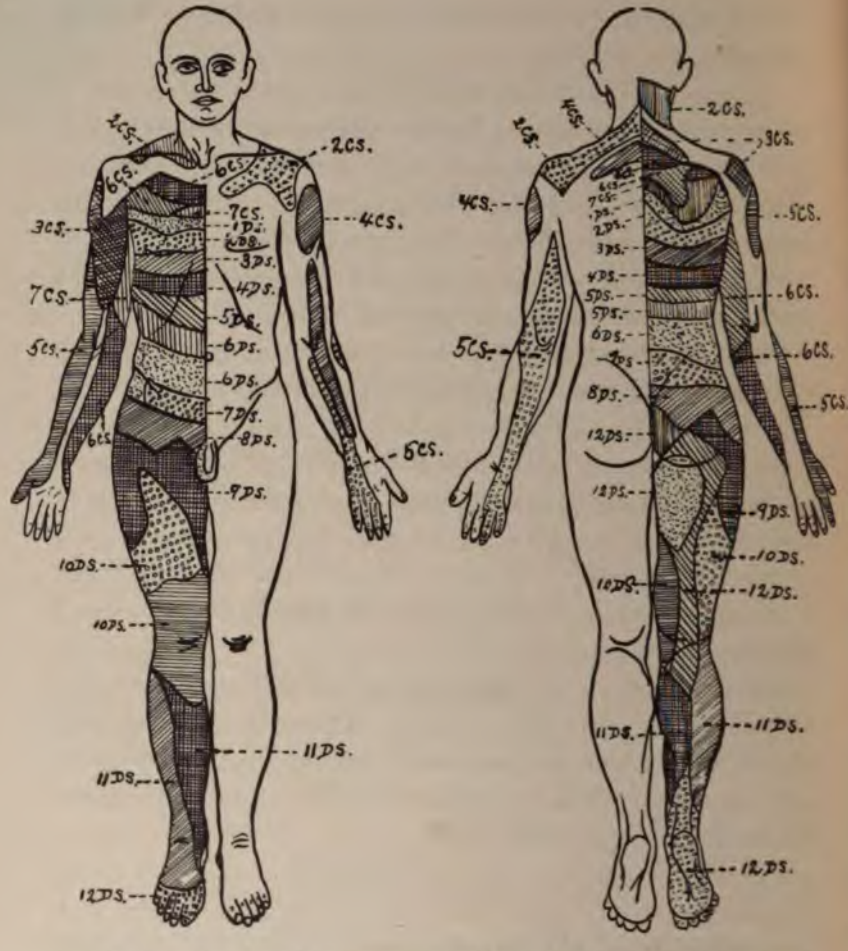


FIG. 92.—Showing skin-areas corresponding to the different spinal-segments. The numbers refer to the various *spinous processes* which are related to the segments and which, when concussed, sinusoidalized or frozen, cause *analgesia* in the different skin-areas. C, cervical; D, dorsal; S, sacral. Thus 5DS signifies that concussion, sinusoidalization or freezing of the region corresponding to the fifth dorsal spine will render the skin-area analgesic related to the 8th dorsal segment.

FIG. 93.—Showing skin-areas on the posterior surface of the body corresponding to the different spinal-segments. The numbers refer to the various *spinous processes* related to the segments of the cord.

Reference to Fig. 10, shows that the segment in question is related to the 12th dorsal spine. The author has simplified segmental-localization in Figs. 92 and 93.

Assuming that a patient has a neuritis in the region of the arm corresponding to the 5th cervical segment (C_5, Fig. 92). If one now concusses the 3rd cervical spine (which is related to this segment), the spontaneous pain disappears and analgesia may be noted objectively in C_5.

Concussion is without doubt superior to slow sinusoidalization and freezing in effecting this object.

In most instances, this analgesic effect is noted after concussion for about three minutes, although a longer time may be necessary to effect this object. The duration of the analgesia, *i. e.*, insensitiveness to the prick of a pin, is usually of shorter duration than the relief from pain experienced by the patient. Although the pain-sense is abolished, the sense of touch may be intact.

Another example may be cited illustrating the importance of segmental-analgesia. A patient has lumbago and the sensitiveness of his skin does not permit of the local application of a sufficiently strong sinusoidal current. Note that the skin of the lumbar region corresponds approximately to the 9th, 10th and 11th dorsal segments, which in turn are related to the 5th, 6th and 7th dorsal spines. If the latter spines are now concussed for several minutes, the analgesia of the lumbar region permits of the electric application equal to at least three times its original strength.

SEGMENTAL-LOCALIZATION BY THE ELICITATION OF VERTEBRAL TENDERNESS.

This subject has already been discussed on page 71. In brief, when a sensitive peripheral structure is subjected to pressure (*e. g.*, a sensitive nerve), or manipulated (*e. g.*, a

sensitive joint), within a minute an area of vertebral tenderness (corresponding to the roots of the spinal nerves) may be elicited by deep pressure at the exits of the nerve or nerves. This area of paravertebral tenderness is usually of short duration.

To locate the segment of the cord related to this area, the spinal nerve may be traced to its segment (Fig. 10), or the table on page 37 will show its relation to the spinous processes.

The fact of the matter is that the author's method of concussion-analgesia shows that the skin-areas ordinarily accepted as related to definite spinal-segments are only partially correct. It is, for the latter reason, as will be discussed later (under freezing), that segmental-localization by the elicitation of vertebral tenderness is often preferred.

> A patient has an inflammation of the shoulder-joint (omarthritis) with adhesions. It is necessary in consequence of the latter to give relief to the ankylosis and pains, but owing to the pain consequent upon manipulation of the joint, it is impossible to execute sufficient force. There are no areas of vertebral tenderness until after manipulation of the joint for several seconds, when tender points may be detected corresponding to the 2nd, 3rd and 4th dorsal spines. The spinal nerves which make their exit at these points correspond approximately to the 2nd, 3rd and 4th dorsal segments. Therefore, after concussion of the 6th and 7th cervical spines and 1st dorsal spine for about three minutes, the shoulder-joint may be manipulated with almost as little pain as though the patient were under the influence of an anesthetic.

From a therapeutic standpoint, it may be argued that the relief of pain secured by concussion is merely palliative and is productive of no better results than from the employ-

ment of the conventional analgesics. In a sense, this contention is correct for the author has had recourse to concussion daily or even twice daily, for weeks in many cases of neuritis and other painful affections, securing thereby only relief from pain.

However, in some chronic painful affections, concussion was almost marvelous after several applications in giving permanent relief.

Here one is constrained to conclude that the lesion is not peripheral, but central, and that direct spinal-concussion effects some intra-spinal change (*vide* physiology of spondylotherapeutic methods).

SEGMENTAL LOCALIZATION OF THE PERIPHERAL NERVES.

Lesions of the peripheral nerves yield symptoms quite distinct from those of the spinal cord itself. The sensory symptoms consist essentially of numbness and tingling in the areas related to the peripheral nerves and the perception of pain, touch and temperature are usually only slightly impaired. The affected nerve is very sensitive to pressure and *points douloureux* (page 185) may be detected along the course of the nerve. The peripheral distribution of sensory nerves (after Bailey) is shown in Figs. 94 and 95, and by consulting Fig. 10, their relation to the spinal-segments may be determined. The latter fact is of importance when it is desirous of annihilating (by concussion-analgesia) pains of the nerves in question.

THE TRIGEMINUS NERVE.

Reference to Fig. 15 shows that only a small part of the skin of the head and face is supplied by the cervical spinal nerves. The sensory division of the trigeminus supplies

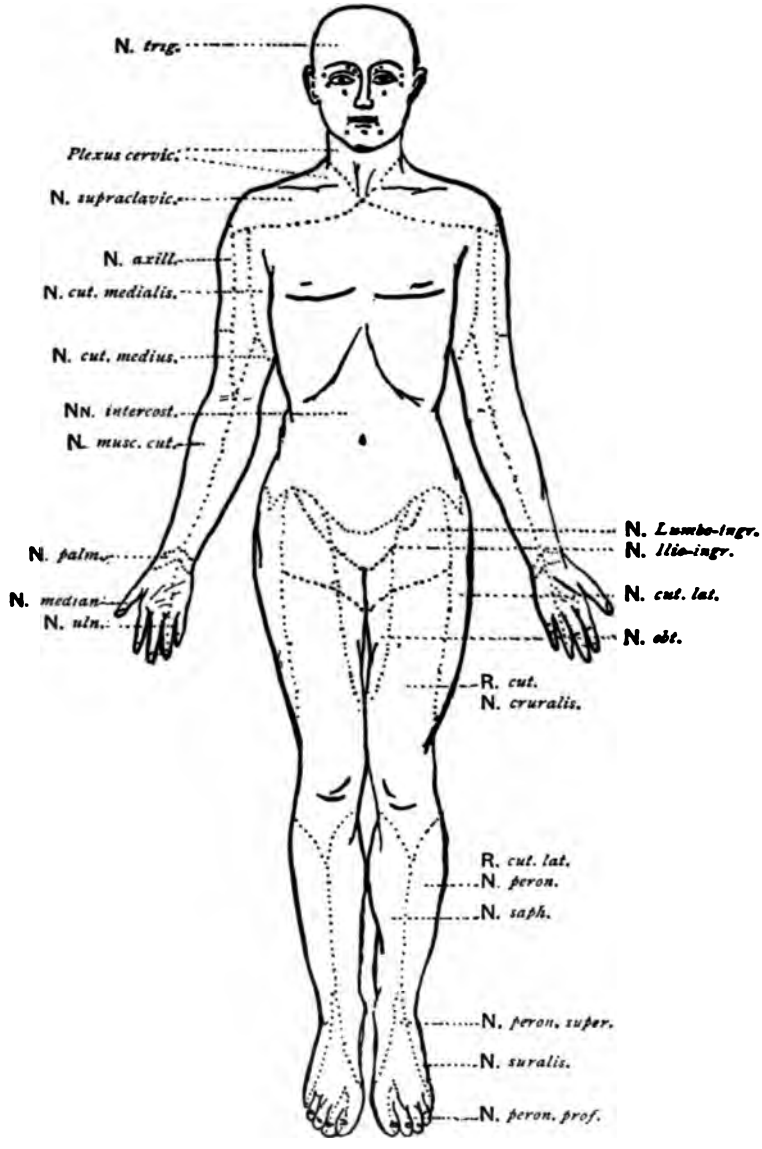


FIG. 94.—Peripheral distribution of sensory nerves.

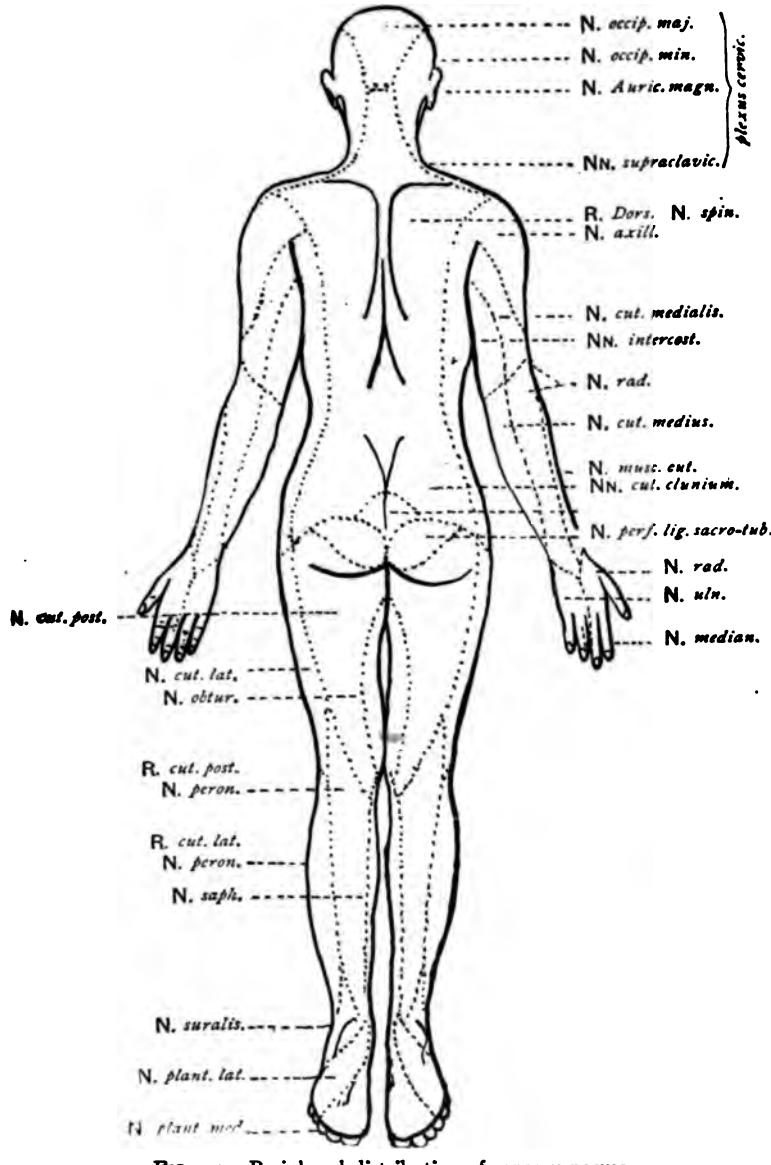


FIG. 95.—Peripheral distribution of sensory nerves.

the skin of the face, the mucosa of the mouth and nasal cavities and the cornea.

The author has endeavored to influence the sensory functions of the trigeminus by concussion, sinusoidalization and freezing over the site corresponding to the location of the Gasserian ganglion (Fig. 96), from the sensory cells of which the sensory root of the trigeminus arises. The results have not been as good as when the spinal nerves are similarly influenced. Here freezing (at the site of the Gasserian gan-

FIG. 96.—The trigeminus or 5th cranial nerve with its three chief branches arising from the Gasserian ganglion.

glion) and sinusoidalization are more effective than concussion.*

SINUSOIDAL-ANALGESIA.

The sinusoidal current is less effective than concussion in producing segmental-analgesia. Only the *slow sinusoidal current* is effective for this purpose and it is obtained from the Victor multiplex sinusoidal outfit. The current bombards the segment with a series of painless concussion-blows. A

*The author has not had a sufficient number of cases of neuralgia of the trigeminus nerve to test the value of freezing and the *slow* sinusoidal current (one electrode to the back of the neck and a smaller electrode over the Gasserian ganglion). The suggestion having been given, however, dentists may elaborate on the method and test its efficiency.

strong current must be used and the duration of the séance must not be less than five minutes. Small electrodes are placed on either side of the spinous process (corresponding to the segment), or, if more spinous processes represent the segmental area of pain, the electrodes are placed along the line of the spine so as to cover the entire segmental area.

SEGMENTAL-PSYCHROTHERAPY.

Reference has already been made on page 172 to the subject of psychrotherapy. Freezing acts more rapidly than the slow sinusoidal current and concussion in producing segmental analgesia. It is used exclusively by the author in influencing visceral sensation. The effects, however, in comparison with the other methods are not as permanent, and one is handicapped in its repetition by the soreness of the skin which it produces. It may be repeated, however, several days in succession when ether is employed for congelation.

To inhibit peripheral and visceral pain either the spinous process over the segmental area is frozen or what is equally efficient, freezing is executed over the areas of vertebral tenderness corresponding to the point of exit of the spinal nerves from a given segment.

> A patient has a painful shoulder-joint in association with a neuritis. Manipulation of the joint develops areas of vertebral tenderness (previously absent) at the points of exit of the 2nd, 3rd and 4th spinal nerves. These areas are marked with a pencil. Pressure over the sensitive nerve develops an area of vertebral tenderness at the 7th cervical nerve corresponding to a point between the spines of the 6th and 7th cervical spines. The latter area is also marked with a pencil. Thorough freezing over the 2nd, 3rd and 4th spinal nerves inhibits the pains in the shoulder-joint and freezing over the 2nd,

3rd and 4th spinal nerves arrests the pains of the neuritis. The treatment to be effective must be repeated daily. In some instances it is advisable to freeze not only the points of exit of the spinal nerves, but likewise the segments corresponding to these nerves. In intractable cases, the author has recourse to re-enforced freezing (page 173) or he connects a large hypodermic needle with his atomizer by means of rubber tubing and freezes (with ether) the subcutaneous tissues by aid of the needle.

SEGMENTAL-ANALGESIA OF THE VISCERA.

The reader is referred to page 58, where consideration was given to the dermatomes of Head. It may be observed that the latter noted that the distribution of the lesions in patients with herpes zoster corresponded with the areas of cutaneous pain and tenderness occurring in certain visceral affections and by comparing the areas implicated in cases of herpes zoster with disturbances of sensation in a number of cases of nervous diseases (with lesions of the spinal cord), he was able to map out the dermatomes. The latter correspond to the segments of the cord and not to the peripheral distribution of the posterior roots.

In the following table the author has located the segments of the cord related to the viscera after the following manner; repeated manipulation of a sensitive viscus will develop an area of vertebral tenderness corresponding to the roots of the spinal nerves. Having located the sensitive nerves, it was not difficult to trace their relation to definite spinal-segments.

SPINAL-SEGMENTS ASSOCIATED WITH VISCERAL SENSATION.*

ORGAN.	SEGMENT OF CORD.	RELATION TO SPINOUS PROCESS.
Heart.	III C and I, II, III D.	2nd, 6th and 7th C.
Lungs.	IV C and I, II, III, IV, V, VI, VII, VIII, IX D.	2nd, 6th, 7th C and 1st, 2nd, 3rd, 4th and 5th D.
Breast.	IV and V D.	1st and 2nd D.
Esophagus.	V, VI, VIII D.	2nd, 3rd, 4th and 5th D.
Stomach.	III and IV C and VI, VII, VIII, IX D.	1st and 2nd C and 3rd, 4th and 5th D.
Stomach (*Cardiac end*).	VI and VII D.	3rd and 4th D.
Stomach (*Pyloric end*).	IX D.	5th D.
Intestines.	IX, X, XI and XII D.	5th, 6th, 7th, 8th D.
Appendix.	X and XI D.	7th D.
Rectum.	II, III, IV S.	12th D.
Spleen.	XI D.	7th D.
Liver and Gall-bladder.	VII, VIII, IX, X D.	4th, 5th and 6th D.
Kidney.	X, XI, XII D.	6th, 7th, 8th D.
Ureter.	XII D and I L.	8th, 9th D.
Bladder.	XI, XII D, I L and I, II, III S.	7th, 8th, 9th, 12th D.
Prostate.	X, XI, XII D, III L and I, II, III S.	6th, 7th, 8th, 10th, 12th D.
Epididymis.	XI, XII D and I L.	7th, 8th, 9th D.
Testicle and Ovary.	X D.	6th D.
Uterus and appendages.	X, XI, XII D, I L and I, II, III, V S.	6th, 7th, 8th, 9th, 12th D.

SEGMENTAL-ANALGESIA IN DIAGNOSIS.

"The Paris Neurological Society" concluded that all the symptoms legitimately included under *hysteria* are imposed by suggestion, and this conclusion refers with all cogency to the traumatic neuroses. The latter, it is argued (spinal commotion), cannot give rise to symptoms of the character

*C, cervical; D, dorsal; L, lumbar; S, sacral.

and duration complained of by the victims of "railway spine." The foregoing contention cannot be correct insomuch as the author has endeavored to show that concussion of definite spinal-segments in even normal subjects will produce analgesia and anesthesia in definite regions of the body.

Suggested, auto-suggested and hysteric pains are amenable to diagnosis by segmental-analgesia.

Let one assume that the patient has a joint-pain. If the skin over the segment corresponding to the joint in question is frozen, or the spine is concussed, temporary evanescence of the pain should ensue. The foregoing observation is equally applicable in the hyperalgesia of neurasthenic patients.

NEURALGIC PAINS may be *peripheral, i. e.*, they are localized in areas corresponding exactly to the peripheral distribution of the nerve-trunk or nerve involved (Fig. 94).

Here, thorough freezing over the entire area of sensitiveness will inhibit the pains. The pains may be due to *irritation of the sensory roots*. Here, freezing at the vertebral exit of the affected nerves will assuage the pains.

The pains may be *intravertebral in origin* (spinal-tumors, tabes, myelitis, syringomyelia, etc.) Here, freezing of the spinal segments is alone effective in inhibiting the pains.

In *pains of visceral origin*, the author employs freezing to the exclusion of other expedients in diagnosis.

Let us assume that the differential diagnosis rests between an appendicitis and a liver or gall-bladder disease. Referring to the table on page 377, it will be noted that the 10th and 11th dorsal segments are related to the appendix. If now, one freezes *thoroughly* the region corresponding to this segment (7th dorsal spine), the pains, if caused by appendicitis, will be inhibited.

Again, after such freezing, the previously sensitive appendix may be palpated without pain.

Thus it is, one may exclude definite viscera as implicated in disease.

Assuming one has palpated a sensitive organ supposed to be the kidney.

In the table already referred to, the 6th, 7th and 8th dorsal spines are related to the segments associated with the kidney. If the spines in question are concussed or the skin over them is frozen, manipulation of the organ (if it is the kidney) should be painless.

The *dermatomes of Head* should no longer be in evidence if definite spinal-segments related to the different viscera are frozen or concussed.

Associated painful areas related to visceral disease (Fig. 27) should disappear when the segments corresponding to the viscera are concussed, sinusoidalized or frozen.

In visceral disease, the irritation develops an area of vertebral tenderness which is accentuated by palpation of a sensitive organ (page 369). Here, freezing of the area of tenderness will not only inhibit the pain, but will permit of painless palpation of the organ. The vertebral tenderness from cutaneous or visceral irritation is usually temporary in duration, and when the tenderness persists, it is probably due to changes in the roots of the spinal nerves (ascending neuritis). It is in this way only that one is able to account for the pains which outlast the cure of a visceral disease (excluding, of course, conditions in juxtaposition to the organ). The author has never been able to influence the sensibility of the rectum.

PHYSIOLOGY OF SPONDYLOTHERAPEUTIC METHODS.

Physiologists are not in accord whether the spinal cord,

like the peripheral nerves, reacts directly to electric and mechanic stimuli. Those who oppose the excitability of the cord claim that any reaction is dependent on stimulation of the roots of the spinal nerves which give rise to movements or sensation.

The clinician, however, has evidence to show that the spinal cord is excitable to direct stimulation.

Experiments show that most motor nerve-cells discharge their motor impulses at a rate of about ten per second, and if these cells are stimulated artificially, the motor discharge is about the same rate as the normal.

This reaction of the nerve-cells of the cerebrum and cord is endowed with a definite rhythm which has been compared with the rhythmical beat of the heart.

After the discharge of an impulse the cells fall into a refractory phase for a period of time lasting about 0.1 second. When a nerve-cell has discharged a strong impulse as a consequence of summation of its stimuli, it is exhausted, and requires a certain time to be recharged.

CONCUSSION is a mechanic stimulus and is equivalent to a blow, pressure, pinching or section. Mechanic stimuli are only effective when they are applied with sufficient rapidity to produce a change in the form of the nerve-particles. When a motor nerve is stimulated, the resultant is motion and pain if a sensory nerve is stimulated.

If the continuity of the nerve is interrupted or the molecular arrangement is disturbed by a mechanic stimulus, conduction of an impulse is interrupted and the excitability of a nerve is either diminished or extinguished. In conclusion one may say that concussion of short duration augments the excitability of the nerves, but when prolonged, the excitability is diminished or abolished.

PRESSURE if continued upon a mixed nerve, paralyzes

the motor earlier than the sensory fibers. If the pressure is applied gradually, the nerve may be rendered inexcitable without demonstrating any evidence of its being stimulated. Pressure on a mixed nerve extinguishes reflex conduction sooner than motor conduction.

SINUSOIDALIZATION is the equivalent of an electric stimulus. An electric current shows its most powerful action upon the nerves at the moment it is applied, and at the moment when it ceases, and any increase or decrease in the strength of a current acts as a stimulus. When the current is flowing through a nervous structure, a condition known as electrotonus occurs, whereby the physiologic properties of the structure are greatly modified.

The rapid sinusoidal current is stimulating, whereas the slow sinusoidal current yields a series of electric shocks. In the application of the latter current to the spine no motor effects are observed, the action being limited to subduing the sensory component of a spinal-segment.

FREEZING.—The author has endeavored, by a series of histologic examinations, to explain the rationale of freezing as a remedial agent, but the microscope affords no clue. It certainly does not act by counterirritation, insomuch as the latter shows none of the immediate analgesic effects of congelation. The local application of cold probably acts as a shock, thereby diminishing the conductivity of the nerves and annulling the functions of the centers in the cord. The initial contraction of the vessels and tissues is followed by a greater dilatation and turgescence. The sensory nerves are paralyzed with loss of sensibility. In fact, when the temperature is sufficiently low, the excitability of all the nerves is diminished.

SPINAL NERVE-TRUNK ANALGESIA.

It is known that if *cocain* is injected into the tissues about a nerve-trunk, anesthesia follows in the area supplied by the nerve. Anesthesia ensues in about five minutes and lasts about fifteen minutes. It is evident that if the injection is effective, there is an absolute block to the transmission of afferent and efferent impulses. The foregoing fact is of great importance in spondylodiagnosis and spondylotherapy.

For local anesthesia, cocain is usually employed, but owing to the occasional toxic symptoms arising from its use, it has been substituted by *eucain hydrochlorate*, *stovain* and other local anesthetics.

The danger from cocain is minimized if the following precautions are taken: 1, Never inject more than one-third of a grain hypodermatically; 2, Never inject the drug into a vein; 3, Never use it if the kidneys are inefficient; 4, The patient should be in the recumbent posture; 5. Use the infiltration-anesthesia of Schleich. Schleich's formula may now be obtained in tablets and one tablet is dissolved in 100 minims of sterilized water. This formula is absolutely innocuous: the formula No. 3 containing only 1-100 grain of cocain.

The infiltration can be made painless by touching the point where the needle is inserted with pure carbolic acid or by freezing the spot. It is well to remember that if one-quarter of a pound of ice (broken into fine bits) is mixed with one-eighth of a pound of salt and placed in a gauze-bag, the application of the latter to a part causes analgesia in about fifteen minutes.

A hot solution of the Schleich formula is more efficient than a cold solution.

A moderately long needle attached to the barrel of the

syringe is used and made to penetrate the tissues of the back approximating the exit of the spinal nerves as shown in Fig. 10. Assuming that one wishes to make the ulnar nerve analgesic. Reference to Fig. 10 shows that the nerve from which it arises makes its exit between the 7th and 1st dorsal vertebræ and between the 1st and 2nd dorsal vertebræ, hence the infiltration-anesthesia must include the para-vertebral area in question.

One may also recall the fact, if cocain, or its substitutes, are interdicted, that infiltration of the tissues with warm or cold sterile water is often very efficient in causing anesthesia.

CORTICAL SINUSOIDALIZATION.*

In 1870, Herbert Spencer declared that different parts of the cerebrum must subserve different kinds of mental action.

Hughlings Jackson affirmed that the gray matter of the convolutions was really excitable, but physiologists regarded his observations as ingenious speculations insomuch as there was no evidence that the cerebral cortex responded to any of the ordinary stimuli of nerves.

In 1870, Fritsch and Hitzig, established a new era in cerebral physiology, viz., that the application of the galvanic current *to the surface of the cerebral hemisphere* in dogs, gave rise to movements on the opposite side of the body. The latter are movement complexes bringing into play several muscles concerned in various movements or acts and not individual muscles. Thus, the effect of injury to a definite area of the cerebral cortex is the inability to execute particular movements or acts.

*The author's reference to this subject is in the nature of a preliminary report. Its intimate relation to the vertebral reflexes (page 7) justifies its consideration. It has only been investigated physiologically, but its possibilities in clinical pathology are far-reaching.

Our knowledge concerning the psychomotor area in the cerebral cortex emanates from the following sources: 1, Experiments upon the cerebral cortex of monkeys; 2, Electric stimulation of the cortex in human subjects during the progress of a cerebral operation for the object of localizing a diseased area; 3, Clinical observations confirmed by autopsy in cases of cerebral tumors and Jacksonian epilepsy.

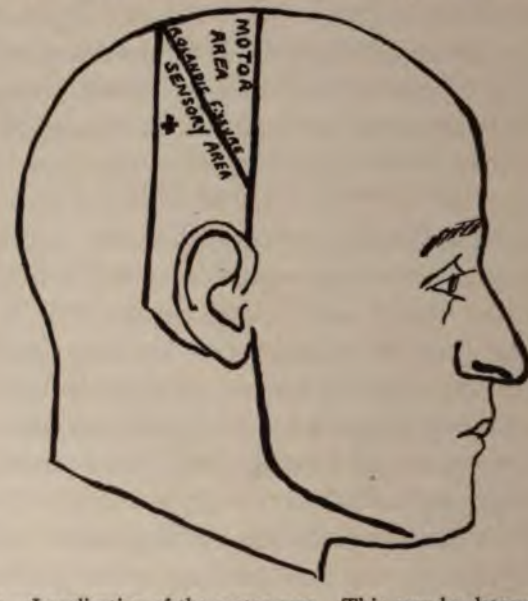


FIG. 97.—Localization of the motor area. This may be determined approximately by drawing two perpendicular lines, one from the depression in front of the external meatus, and the other from the posterior border of the mastoid process at its root; †, most prominent part of parietal eminence.

It has already been shown that spinal muscular reflexes could be elicited by sinusoidalization of definite spinal segments (page 11), and it occurred to the author that the motor area of the cerebral cortex could be similarly influenced. That this is true is evidenced by execution of the following method: Having cocainized the skin of a bald-headed individual, corresponding to the motor area

(Fig. 97), a powerful sinusoidal current (rapid sinusoidal from the Victor or the Kellogg apparatus) was conveyed to the motor area either by an interrupting bipolar electrode or with one interrupting electrode over the motor area and the other over the sternum. By opening and suddenly closing the circuit, muscular contractions were observed in the muscles of the face, arm and leg on *both sides of the body*. Later, it was found that local anesthesia was unnecessary to obtain contractions of the muscles of the face and arm. It is better to employ a bipolar interrupting electrode over the motor area to exclude from participation in the muscular contractions the motor areas of the cord.

One must not conclude that because the co-ordinated movements do not occur exclusively on the opposite side of the body, the clinical observations of the author do not correspond with the physiologic evidence.

On the contrary, stimulation of an area on one side in animal experimentation results in bilateral movements in the case of corresponding muscles on opposite sides of the body that usually act together. Thus, Exner contends that such muscles appear to have a center not only in the opposite but also in the hemisphere of the same side. All observers have noted that stimulation of the facial center results in identical movements on *both sides* of the face.

It has always been a question with physiologists whether similar areas exist in man. If the evidence adduced by the author is sufficient, the question may be answered in the affirmative.

By placing one electrode of a slow sinusoidal current (Victor apparatus) over the *sensory area* (Fig. 97) and the other at an indifferent point and using a strong current for about ten minutes, a moderate grade of hemianesthesia may be produced on the opposite side of the body. Both

sides of the body may be similarly anesthetized by fixing the electrodes on either side of the cranium corresponding to the psychosensory centers of the cortex.

CHAPTER XII.

THE REFLEXES* AND THE PERIPHERAL SYMPTOMATOLOGY OF VISCERAL DISEASE.

PURPORT OF SPONDYLOTHERAPY—GENERAL FEATURES OF REFLEXES—THERAPEUTICS OF REFLEXES—THERAPEUTICS OF CONCUSSION—COMPARISON OF METHODS—TROPHIC FUNCTIONS OF CORD—TROPHIC DISEASES—PERIPHERAL REFLEX PHENOMENA—INSUFFICIENCY OF THE FOOT—TEST FOR THE SPLANCHNIC CIRCULATION—REFLEXES OF THE CRANIAL NERVES.

THE PURPORT OF SPONDYLOTHERAPY.

WHEN the author first suggested the neologism, SPONDYLOTHERAPY, he anticipated no misconception concerning its object, yet "THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION" conceived the following analysis of the work in question:

"*One wonders whether this is an attempt to explain osteopathy and chiropractic to the understanding of the regular practioner, or to exploit the very ingenious percussion devices of the author, or whether it is really true that medical men really know practically nothing about the cure of disease through treatment of the spine. Let us hope that it is the latter, and that a careful study of this unique volume may open new avenues of therapy heretofore undreamed of.*"

Now, osteopathy is a system which concerns itself with *anatomic abnormalities* and their correction. "Its nosology is a lesion, its symptomatology a subluxation."

*The reader should consult the index to find the fundamental facts concerning the visceral reflexes.

Spondylotherapy

Chiropractic presumes disease to emanate from displaced vertebrae.

The *Spinal centers* are referred to in osteopathic and chiropractic textbooks, "with a dogmatism and certainty begotten of beneficial results."

SPONDYLOTHERAPY concerns itself *only* with the excitation of the functional centers of the spinal cord by different methods which may be executed and demonstrated with the same certainty in the living human subject as is done by the vivisectional experimentalist. (This phase of medicine is referred to by the author as "*Clinical Physiology.*") In brief, Spondylotherapy is based on the clinical physiology of the human, in contradistinction to the study of physiology by the laboratory vivisectionist. Thus *human*, and not animal physiology, is made the basis of clinical pathology. In this way one has disproved by clinical observation many apodictic data created in the laboratory.

Whereas spondylophysiology concerns itself with a study of the spinal reflexes, the therapeutics of the latter is embraced by the designation, spondylotherapy.

SPONDYLOPATHOLOGY.—Life is expressed by a rhythmic flow of automatic functions known as reflexes. Each reflex has its antagonistic reflex and, when both are co-ordinated, the result is a physiologic condition.

When they are in a state of inco-ordination, the result is a pathologic-physiologic condition. According to this conception of spondylology, pathology is founded on physiology, and pathology is nought else but the physiology of the sick. Thus, a pathologic-physiologic condition creates its own pathologic anatomy. That is, instead of regarding the morbid tissue-change as a primary requisite of disease, it is in reality secondary to physiology in a state of disequilibration. The real object of the practice of medicine is to cure disease and

it is only the doctrinaire whose fealty invokes the Skodaic pessimism: "We can diagnose disease, describe it, and get a grasp of it, but we dare not by any means expect to cure it." Thus the soulless philosophy which is too generally accepted as scientific medicine permits the scientist to diagnose diseases while the charlatan cures them."

Conservative medicine is too often a practice of trusting to nature and confirming the diagnosis at the autopsy.

We are inclined to forget the Hippocratic allusion to medical art; that it consists of three things—the patient, his malady and the physician.

This is the era of therapeutic medicine, and he who prates about the bankruptcy of therapeutics, substitutes the guinea-pig for a human and the laboratory for the bedside.

Therapeutic nihilism owed its conception to the pathologist, who sought to identify every disease with definite anatomic changes, and his coadjutor, the clinician, studied disease only in relation to these anatomic conditions. Thus, the clinician perpetrated the egregious mistake of associating the autopsic findings with the previous disease, whereas, as a matter of fact, the anatomic changes were sequential to the disease and not the disease itself. In other words, a perturbed physiology created its own pathologic anatomy.

One of the most epoch-making developments of modern medicine is "Physiologic Therapeutics," which regards disease as an expression of morbid physiology and all that affects health, affects disease and that, to promote recovery, one must influence the general health.

That disease is nought else but physiology gone mad is illustrated in bacteriotherapy and in our modern conception of semeiology. Thus, the inutility of bactericides in the treatment of infectious diseases led to an investigation of the

latter from a new view-point, viz.: How does the organism deal with infections?

It was soon demonstrated that the organism possessed chemical defenses and, as a consequence, modern bacteriotherapy developed the therapeutics of immunity by utilizing as antitoxins the same products which the animal organism developed to combat infection or, by attempting to stimulate the organism to an augmented production of such defensive agents.

Again, we have misinterpreted defensive reflex phenomena as symptoms of disease. Thus, *hyperemia*, long regarded as a symptom, is now utilized as a valuable physio-therapeutic method.

Muscular spasm, by immobilizing a diseased joint or spine, or by protecting a sensitive viscus, is an expression of defense.

Fever is probably a salutary process, for by this means the infected body is "cleansed by fire." Pathogenic bacteria thrive best at the normal temperature of the body and they either die or lose their toxic properties with the commencement of fever. The micro-organisms of malignant pustule cannot survive a temperature above 104° F., and thus cannot infect birds, whose normal temperature exceeds this limit. This immunity however, is destroyed if the temperature of the bird is reduced artificially. Our present conception of fever is in accord with the teaching of Hippocrates, that fever is a remedy. That it is "a reaction of the organism striving for a useful end, but that this end may not be reached or that it may be overstepped."

GENERAL FEATURES OF REFLEXES.—Reflexes functionate with machine-like regulation (*regulative reflexes*), and are usually automatic, *i. e.*, independent of our own wills. If one stimulates the nerve of taste, there is a reflex secretion

of saliva and gastric juice. However, one dare not exclude a psychic factor in the mechanism of reflexes. Thus, the mere sight of food causes a secretion of gastric juice; the heart is influenced by emotions, and definite psychic conditions influence the flow of urine. One of the most important objects of the reflexes is to protect the body from external injuries. The protective movements of pithed or decapitated frogs are so purposive in character and so co-ordinated that Pflüger regarded them as directed by and due to "*consciousness of the spinal cord.*"

Just as will may excite a reflex, it may also prevent it (***inhibition of reflexes***). Thus, at well-regulated sanatoria for consumptives, one rarely hears a cough. There patients are disciplined to inhibit a cough and are informed that to cough in public is as much a breach of etiquette as to scratch one's head when it itches. It is still dubitable whether there are definite inhibitory centers or whether there are special afferent inhibitory nerves.

As a rule, a reflex is more easily discharged by stimulation of the peripheral end-organ than by stimulation of the corresponding afferent nerve-trunk. Even though recent physiologic investigations show that some of the secretions are not reflexes in the sense that they are mediated by the afferent nerves, yet in a general way they are still reflexes. It has been shown that the ductless glands elaborate specific chemical products known as *hormones*, which are manufactured in one organ of the body and are conveyed by the blood to another organ or organs where they stimulate physiologic activity by their presence.

Generally the reflexes are local, *i. e.*, they are discharged in the region of the body irritated. If the reflex irritability is increased or if the stimulation is severe, the reflexes may be diffused to regions remote from the area irritated (*reflex dispersion*).

ORIGIN OF THE REFLEXES.—The former view that the spinal cord was the center of all reflexes is doubtful and the following classification of reflexes by Jendrassik is worthy of consideration:

1. *Spinal Reflexes*, include tendon, periosteal and joint-reflexes. They are usually discharged from areas with diminished sensation; are dissociated with any special feeling; mechanic irritation (like a blow) suffices for their discharge; the intensity of the reflex is based on the degree of irritation and not upon its duration; making other muscles tense augments the reflex (Jendrassik's method of reinforcement); the reflexes are augmented when attention is distracted.

2. *Cerebral Reflexes* include the cutaneous reflexes, and they are discharged from sensitive areas. Unlike the spinal reflexes, they are increased or diminished by psychic influences and distraction of the attention impairs them.

3. *Complex Reflexes* include such which are made up of a series of movements like coughing, sneezing, vomiting, defecating, etc. They are discharged by protracted stimulation (*summation of stimuli*); the reflex involves different groups of muscles and even antagonistic reflexes and psychic influences are of greater moment than with the cerebral reflexes.

THERAPEUTICS OF THE REFLEXES.*—When the oculist contracts or dilates the pupil, he employs reflexes in treatment. Contraction of the pupil is controlled by the oculo-motor nerve, which supplies the sphincter pupillae (and ciliary muscle), and dilatation of the pupil is governed by the sympathetic. Thus eserin, which stimulates the oculo-motor nerve contracts the pupil, whereas atropin, which paralyzes the same fibres, dilates the pupil. Thus, in *iritis* the most

*The pharmacology of the reflexes is discussed in Chapter XIII.

important remedy is atropin, because among other effects, the eye is put at rest, owing to paralysis of the sphincter.

The day is fast approaching when improved methods of spinal nerve-trunk analgesia (page 382) will enable us to inhibit or excite reflexes to cure disease. Surgery has already invaded this field in the treatment of *spasticity*, by resection of the posterior spinal-roots (rhizotomy). Here, the object is to inhibit afferent impulses from the muscles which excite the cells of the anterior horns of the cord to send out excessive motor reflexes to the muscles.

In the therapeutic elicitation of the spinal reflexes one must take cognizance of the physiologic data which are applicable clinically:

1. A stronger stimulus is necessary to excite a reflex movement than for the direct stimulation of motor nerves.

2. A reflex movement is of shorter duration than the same movement executed voluntarily and there is a decided delay after the moment of stimulation. The reflex time diminishes as the strength of the stimulus increases.

3. Stimuli must be regarded as various forms of energy and *overstimulation conduces to exhaustion*, when even a powerful stimulus fails to elicit a response.

In other words, weak irritation augments the irritability of the spinal centers; medium irritation benefits them; strong decreases; and very strong abolishes the irritability.

Some of the failures in my early practice in the application of spondylotherapy were due to overstimulation of the spinal-centers. Now, I make short and interrupted séances, a fundamental principle in treatment. Several treatments may be given daily but they must be of short duration. The physiologist employs electric in preference to mechanic stimuli for the reason that they are easily applied and their intensity controlled. He has committed himself to

the Galvanic or Faradic current for electric stimulation and the sinusoidal current receives no consideration in the text-books on physiology.

In my animal experiments I found the sinusoidal current used percutaneously, the only effective one for elicitation of the visceral reflexes. With the use of strong currents over definite vertebral regions, practically every viscus could be made to contract or dilate at will.

In association with contraction, the organ became anemic and conversely, hyperemic when the organ was dilated. These circulatory modifications were due no doubt to the visceral musculature and were quite independent of any action on vasomotor centers.

With repetition of sinusoidalization, however, the visceral reflexes became exhausted and even the strongest stimulation was without effect. After a period of rest one could again elicit the reflexes in question.

THERAPEUTICS OF CONCUSSION.—My observations on concussion, as presented on pages 175 and 380, have been further exploited. No reliance can be placed on the average concussion apparatus; it is what it is intended to be, a mere vibrator. The apparatus which the author employs (Fig. 50), operates with an average pressure of 40 pounds and yields a blow equivalent to 12 pounds. Unfortunately, this apparatus is noisy and compressed air is not always obtainable. To obviate these difficulties the author has devised an efficient electro-concussor.

Methods are frequently discredited for the reason that they are faultily executed.

A physician employed the author's method for several months in a case of aneurysm of the thoracic aorta without results. The patient got progressively worse and the condition was apparently hopeless. My colleague had employed

a mere vibratory toy for treatment. Within a few séances, after vigorous concussion of the seventh cervical spine, the patient began to progress rapidly toward recovery. The author has repeatedly demonstrated that *vibration will not elicit a visceral reflex*, hence it is of no avail in treatment. In the absence of a trustworthy apparatus, the method shown in Fig. 2 should be used. Several physicians have successfully employed the latter method exclusively in the treatment of aneurysms.

Some physiologists deny the excitability of the spinal cord and attribute any reaction to stimulation of the roots of the spinal nerves. On page 170 (Fig. 48), reference is made to the elicitation of visceral reflexes by *paravertebral pressure*.* Now, if one compares the results of pressure with a special instrument (Fig. 112), at definite paravertebral areas, with concussion executed in the usual way (concussors applied *directly* to the spinous processes), the following results were obtained in the same subject, with the stomach reflex of contraction:

> After five minutes concussion of the first lumbar spine the amplitude of the reflex was 2 cm., and its duration, one-half minute. After pressure on both sides of the first lumbar spine for one-half minute, the amplitude of the reflex was 3 cm., and its duration, 15 minutes. Here, the results were clearly shown to be due to nerve-trunk stimulation and not to segmental excitation.
>
> Later, the author evolved a special kind of metallic concussor, as shown in Fig. 98, which concusses both sides of the spinous process, instead of direct concussion of the latter.

This concussor fitted into the pneumatic hammer, or the apparatus of the author, elicits visceral reflexes of greater

**Vide* Chapter XIII for a more extended discussion of this subject.

amplitude and of longer duration than when the spines are directly concussed.

SLOW AND RAPID CONCUSSION.—The physiologist attains different results from stimulation according to whether the stimulus is applied rhythmically at a slow or rapid rate.

Fig. 98.—Concussor which delivers blows to both sides of a spinous process. It is of metal and covered with layers of felt and rubber to eliminate any possible traumatism resulting from concussion.

My clinical results are in accord with the foregoing observation.

> Thus, a liver by percussion measures 12 cm.; after rapid and continuous concussion, it measures 8 cm., and after slow and interrupted concussion-blows, it is still further reduced to 6 cm. After concussion of the first three lumbar spines to elicit the stomach reflex of contraction, rapid blows caused a recession of 1.7 cm. of the lower border of the stomach, whereas slow and interrupted blows resulted in a recession measuring 3.5 cm.
>
> In this, as in all other recorded observations, the same blow and pressure were used and the duration of treatment was the same. For the purpose of contracting the viscera, slow and interrupted concussion-blows are more efficient than rapid and continuous blows.

To secure dilatation of blood-vessels, the slow and interrupted concussion-blows are equally more efficient. Thus, in an aneurysm which has a transverse diameter of 6 cm., rapid and continuous blows to elicit the aortic reflex of dilatation increase the diameter to 8.3 cm., whereas slow and interrupted blows increase the diameter to 9.5 cm.

To contract blood-vessels (and aneurysms), rapid and continuous blows are more efficient.

Thus, an aneurysm with a diameter of 7 cm., is, after slow and interrupted blows to elicit the aortic reflex of contraction, reduced to a transverse measurement of 5.8 cm., whereas, after rapid and continuous blows, the transverse diameter is reduced to 1 cm.

COMPARISON OF METHODS.—It is only possible in a general way to say what is the most efficient method for eliciting the visceral reflexes.

Like all cells, the neurones do not react to the same stimulus. Electricity with weak currents increases, and strong currents decrease the activity of the cells.

Unfortunately few physicians are sufficiently skilled in percussion to determine for themselves the best method to employ. Very often the *rapid* sinusoidal current is more efficient than concussion. Thus, in a patient with an aortic aneurysm, the following comparative results were obtained in eliciting the aortic reflex of contraction:

METHOD.	DURATION OF TREATMENT.	DURATION OF REFLEX.
Concussion.	1 min. to 7th cervical spine.	12 minutes.
Rapid sinusoidal current.	1 min. to both sides of same spine.	36 minutes.

STOMACH REFLEX OF CONTRACTION.

METHOD.	DURATION OF TREATMENT.	DURATION OF REFLEX.
Slow blows directly to spinous process.	One-half minute.	3 minutes and 35 seconds.
Slow blows to both sides of spinous process.	One-half minute.	16 minutes.
Slow sinusoidal current to to both sides of spine.	One-half minute.	8 minutes.

VASODILATOR LUNG REFLEX.*

(Application to the 10th dorsal spine.)

METHOD.	DURATION OF TREATMENT.	DURATION OF REFLEX.
Concussion.	1 minute.	45 seconds.
Rapid sinusoidal current.	1 minute.	6 minutes.
Slow sinusoidal current.	1 minute.	No result.
High-frequency current.	1 minute.	4 min., 10 sec.
Paravertebral pressure.	1 minute.	10 minutes.

When pressure exceeded one minute, the dullness was of short duration. *The reflexes are more easily exhausted by pressure than by any other method.*

For discharging visceral reflexes, the *rapid* sinusoidal current is always more efficient than the slow current. With different sinusoidal machines one secures discordant results.

Fig. 99.—The McIntosh polysine generator.

*This reflex is fully discussed in Chapter XVI, page 606, and is associated with dullness of the lung. Here, *duration of reflex* refers to the duration of dullness.

In my investigations, the Polysine Generator (Fig. 99), made by the McIntosh Battery and Optical Co., of Chicago, was employed. The dial selector attached to this apparatus obviates the necessity of learning by rote the operation of the many switches in order to obtain the required combinations.

The ***high-frequency current***, applied by means of a double vacuum electrode (Fig. 100), to either side of definite spines,

Fig. 100.—Double Vacuum Electrode.

will elicit visceral reflexes of great amplitude and long duration. For this purpose, in some instances it is more effective than the other physio-therapeutic methods.*

The ***visceral musculature*** is of the non-striped variety, which is more easily fatigued than striped muscles. Excessive stimulation of muscle results in degeneration of the latter. If a muscle is stimulated by maximum induction-shocks until it ceases to contract, its excitability may be restored by massage, the constant current, veratrin, permanganate of potash, or rest.

*The author has investigated the *Leduc* (direct interrupted current of low tension) and *thermopenetrating* currents, and finds them of no value in the elicitation of visceral reflexes by vertebral excitation.

The foregoing facts may be illustrated clinically in the use of physio-therapeutic methods. Thus, if the visceral reflexes can no longer be elicited after the prolonged use of one method of excitation, another method may evoke a response.

In a patient with a large aortic aneurysm every symptom had practically yielded in about two weeks to treatment by concussion, excepting a slight cough. Recourse was then had to the *rapid* sinusoidal current on either side of the seventh cervical spine and within a few days this vestigial symptom of the disease disappeared.

An elderly gentleman was practically moribund on two occasions and was restored to comparative comfort by concussional treatment. A slight dyspnea on exertion with a rapid pulse persisted despite treatment. Within a few days after daily hypodermic use of strophanthin, dyspnea and tachycardia disappeared. This same drug prior to concussional treatment was ineffective. Thus, drugs must be employed as succedanea for physio-therapy and the latter for drugs.

TROPHIC FUNCTIONS OF THE SPINAL CORD.—Aside from the function of the cord as a conductor of impulses, one must not disregard its puissant function of presiding over muscular, cutaneous, osseous and arthritic nutrition. The trophic control is probably resident in the gray matter. Lesions of the lower motor neurone cause atrophy or dystrophy of the muscles. To question the existence of trophic nerves is a mere matter of logomachy. Suffice it to say that the nerve-cells of the cord maintain the normal state of nutrition of the organs and tissues and implication of the cells predicates definite trophic disturbances.

CELL-STIMULATION.—The essential principle of living substance is its property of altering its metabolism and transforming its energy. This principle is known as *irritability*, and the agents which can excite it (heat, light, electri-

city and chemic and mechanic agents), are known as *stimuli*. The metabolic change resulting from stimulation may develop kinetic energy and the cellular condition is known as excitation, or potential energy is developed and the cellular condition is known as its *trophic effect*.

Stimuli which may evoke the former propitious effect may also check metabolism (cellular paralysis). The following observations on cell-stimulation are axiomatic:

1. The development of energy is greater than the energy of the stimulus used.
2. Cells summate the effects of stimuli. With a rapid succession of stimuli, contractions may be evoked which are stronger than that obtained by a single stimulus.
3. Cells always react in a specific way, irrespective of the nature of the stimulus; a muscle-cell responds with contraction; the cell of a salivary gland will secrete saliva.
4. Stimuli are transient in their action and *overstimulation always conduces to exhaustion*. I have italicized the latter fact to emphasize its importance. It applies with equal cogency to pharmaco-, or physio-therapy.

TROPHIC DISEASES.—There are a number of diseases characterized by nutritional disorders in which the lesion is probably resident in the gray matter of the cord or in the peripheral nerves (which comprise the lower motor neurons presiding over nutrition). The trophic impulses usually traverse the motor nerves. It is only necessary to mention several trophic diseases in which I have employed concussion as a mechanic aid to cell-stimulation.

ARTHRITIS DEFORMANS.*—This disease is recognized by the following:

*This affection is likewise discussed on page 105.

1. Muscular atrophy precedes the involvement of the smaller and unusual joints (maxillary articulation, fingers, toes).

2. Presence of trophic or pigmentary lesions in juxtaposition to the implicated joints and stiffness or soreness antedating the actual inflammatory changes.

3. Persistence of the condition when a joint is once attacked.

4. The negative action of the salicylates (page 142), and the infrequency of endo or pericarditis excludes rheumatism.

5. Gout is excluded by the absence of movable deposits of sodium urate in the soft parts beneath the skin. In the monarticular form of arthritis deformans, large joints (shoulder, hip, knee), may be involved. When the hip is involved, it corresponds to the condition known as morbus coxae senilis.

It is usual to regard arthritis deformans as a chronic infection, an hypothesis which has supplanted the view once held that it was associated with lesions of the spinal cord. In accordance with this theory, I have employed concussion of definite vertebrae. While my results have not been phenomenal and I have not restored the shape of crippled joints, pains were subdued, a modicum of function was restored to the joints and I believe the progress of the disease was arrested.

In 1831, Prof. K. Mitchell, associated this affection with lesions of the ganglion-cells of the anterior horns (congestion) and he successfully treated this and chronic forms of rheumatism by cupping and blistering. From 8 to 16 ounces of blood were abstracted from the regions corresponding to the cervical (upper extremities affected,) or lumbar enlargements (lower extremities affected). When cupping was unsuccessful, blistering was employed in the same regions.

Latham[80], and others, have recently reported brilliant results in hopeless cases following thorough and repeated blistering.

Freezing, in my experience, is more efficient and less troublesome than blistering. Unless the results are immediate (less pain and stiffness), nothing can be expected from repetition of the treatment. When the upper extremities are involved, one should freeze in the region of the cervical enlargement of the cord (3d cervical to 2d dorsal vertebra), and to influence the lower extremities, the entire region corresponding to the lumbar enlargement (9th dorsal to 1st lumbar vertebra) should be frozen.

The employment of *dry hot air* in this disease has been highly commended by a number of observers. However, to be efficient, the air must attain a temperature of from 350° to 400° F. A lower temperature gives indifferent results.

Thermotherapy is often discredited for the reason that the amount of heat applied to a part is insufficient. The fact of the matter is that as long as the peripheral circulation is maintained, neither extreme heat nor cold shows penetrating power of sufficient practical value. The latter objection I have often obviated by making an extremity anemic by aid of a rubber bandage.

When a multiplicity of remedies are recommended for an individual disease, it is less a reproach to physiologic pharmacology than it is to pathology. The latter, for many diseases, is not definitely established and it varies according to the stage of the disease and the reaction of the individual.

Among the physio-therapeutic methods which have recently enjoyed therapeutic *renomée* in the treatment of arthritis deformans and other affections, is thermopenetration.

Insomuch as the latter has given excellent results accord-

ing to a method original with myself, I shall give it special consideration.

DIATHERMIC SPONDYLOTHERAPY.—The local application of heat has always been recognized as a valuable empiric method of treatment.

The physiologic action of heat is produced by irritation of the cutaneous nerve-endings manifested by dilation of the blood-vessels, augmented functionation of the sweat-glands with increased local elimination, improved nutrition of the tissues and changes in the cellular metabolism resulting from the increased temperature of the part.

Perhaps the most important physiologic action of heat is to produce *hyperemia*. The latter is nature's own remedy and occurs with the regularity of a natural law.

Among the effects of hyperemia are: Relief of pain, bactericidal action, resorption property of dissolving blood-coagula, exudates in joints and tendons, etc.

Heretofore, the different methods employed for raising the temperature of the subcutaneous tissues suffered the drawback of injuring the skin. The latter is a very poor conductor of heat and investigations show that it is practically impossible to raise the temperatures of the subcutaneous structures by the conventional methods of using heat to the skin.

It has been found that a high potential oscillating current

of the subcutaneous structures is known as diathermy, transthermy and thermo-penetration. In the conventional use of diathermy, notably in affections of the joints, the electrodes are applied opposite each other and the current is used to the point of toleration as long as possible. The high-frequency current for diathermic purposes is devoid of chemic action provided sparking is prevented.

In my experience, the heat generated by the current is so great that patients can only tolerate it for a very limited period of time. To obviate the latter objection, the sponge contacts are immersed previous to application in a saturated solution of *ammonium nitrate.*

Applied directly to the affected joints in arthritis deformans, there is a local reaction manifested by swelling, pain and stiffness of the joint. This reaction is less accentuated with repetition of the treatment, which, if successful, yields results after a few séances.

Better results in my experience, however, follow the use of diathermy to definite vertebral areas.

As a rule, one finds sensitive vertebral areas on pressure corresponding to the joints involved and the electrodes are then applied on both sides of the spine.

LOCOMOTOR ATAXIA.—The exact seat of the initial lesion in tabes is dubitable but there is every reason to believe that it is primarily an inflammation of the posterior nerve-roots or the ganglion-cells in the posterior ganglia are first implicated. In my experience, diathermy is practically a specific for the characteristic pains of this disease which follow dorsal root-areas.

Figs. 92 and 93 show the vertebral sites for the application of the diathermic current. Thus, if the pains are located below the knees, the electrodes are placed on either side of the spinal column corresponding to the 11th and 12th dorsal

spines. The same method is applicable in pains of spinal origin which prove refractory to conventional treatment. Here, the morbid anatomy is practically identical with early tabes, viz., a radicular meningitis.

THE FUNCTIONAL SPINE.[81]—In this condition, diathermy is also very effective. In the functional spine, pain is felt in the region of the lower dorsal and upper lumbar spine. It is in the nature of an ache and stiffness on attempting to straighten up from a stooping posture or in getting up in the morning. Limitation of motion is caused by muscular spasm.

DISEASES OF THE MOTOR TRACT.—Atrophic change in the motor neurons is the basic anatomic lesion in these diseases and concussional treatment should be given a trial. In one case of Polio-Myelitis, in which both legs were affected and the paralysis had failed to yield to conventional treatment, an almost complete cure was effected by vertebral concussion. The affected muscles began to react to the induced current after twelve séances*

If the lower extremities are implicated, concussion is executed in the region corresponding to the lumbar enlargement (9th dorsal to 1st lumbar vertebra).

BERI-BERI.—This disease, which is very prevalent in tropical countries, is characterized by motor and sensory paralysis and atrophy of the muscles. Among the clinical

U. S. A. T. "*Seward*,"
MANILA, P. I., May 7, 1910.

"In answer to your letter of inquiry concerning my experience in the treatment of *chronic beri-beri*, it gives me pleasure to inform you that *remarkable results* have been obtained by means of a series of concussions, made by the strokes of a rubber-tipped hammer, weighing about one ounce, on both sides of the spinal column, over the exit of the nerves supplying the parts of the body diseased.* The exact technique used is that described in your monograph, "The Treatment of Aneurysm by Spinal Concussion."

For a weak heart, concuss the nerve at its exit from the third dorsal; to affect the muscles above the knee, and calf of legs, concuss the nerves at their exit from the third and fourth dorsal, those of the plantar muscles, the nerves from the fourth sacral. As the hammer falls gently over the nerves near their exit from the spinal column, a play of the muscles may be seen successively, as each group is concussed.

The patient arises from the séance with a sense of renewed strength in the use of the muscles, which heretofore had failed him in walking.

There is improvement from the first treatment. Each treatment lasts about five minutes, and is given daily for five to twenty days. There is often some trouble in locating the nerve. Make exploratory taps and, when the expected reflex action shown by the contracting muscle is seen, it is well to mark the spot by a point of indelible ink.† Locate all the nerves it is desired to concuss; this having been done, dismiss the patient to return the next day.

At the second and subsequent sittings, let the hammer play over each nerve—guided by the ink-spots; on first one and then the opposite side of the column, going up and down the column much as the fingers of the

Vide Fig. 2.
Carbol fuchsin is better for dermography

piano player following the scale on the white and black key-boards. Tap with the hammer gently, with just sufficient force to cause the muscles to respond.

My experience has been limited to six cases. The first, a man 37 years, had beri-beri five years previously. Ever since his recovery from the acute symptoms he had not been capable of continued exertions for more than a few minutes without feeling a fainting sensation. The only organic trouble discernible was a distinct hemic murmur of the heart. He had taken the usual tonics with but little effect. I proceeded to concuss the nerves on both sides of the spinal column only opposite the third dorsal vertebra. The effect was beneficial. After the seventh sitting he declared himself well. His hemoglobin count had risen from 60 to 80. I saw him a month later, the picture of health and no murmur noticeable.

The third case was a soldier, 22 years old, who had beri-beri eighteen months previously, was returned to duty after a month in the hospital but was unable ever to do full duty. When I saw him his captain had just forwarded a request for his discharge. He could not make more than two or three hundred yards without "falling out," because of weakness of his knees, legs and feet. Treatment was begun at once with the result that within two months he was doing full duty, even to scaling a 12-foot wall. In not one of the six cases was any medicine used. Good hygiene and proper food were the only synergists used. In one only, the heart symptoms predominated. The other five had the lower extremities affected, and of these five, three were cured, the other two markedly improved.

Wishing you every success in your pioneer work to make scientific the treatment of chronic and heretofore incurable affections resulting from apathetic conditions of the nervous system,

I remain very sincerely,

G. W. DAYWALT,
1st Lt. Med. Res. Corps, U. S. A.

Beri-beri is essentially a ***multiple neuritis*** and concussion is indicated in the latter disease after the acute symptoms have subsided.

THERAPEUTIC-PHYSIOLOGY OF CONCUSSION.*—Numerous correspondents have solicited further information concerning this subject. What is said of concussion refers with equal cogency to other methods for eliciting the visceral reflexes and, if aneurysm is selected as a paradigm, it is because it has been made the subject of the most frequent interrogation.

The balneologic treatment of heart-disease by Nauheim baths has shown itself to be of great value and is based on sound physiologic principles. Schott, who inaugurated this treatment suggested among other things, that the good results were due to a reflex stimulation of the heart which evokes slower and more powerful contractions of the organ. In other words, one elicits by this method the heart reflex as suggested on page 218.

MUSCLE TONUS refers to a continuous (however slight) contraction of muscle under normal conditions and which is maintained by subminimal nerve-impulses constantly discharged from nerve-centers into the muscles. In this way, the neuro-muscular apparatus is in a condition of tonic activity. Thus, the sphincters in the norm are in a state of tonic contraction. Tonus is of the greatest importance in clinical medicine as we shall learn in chapter XIII. It is most probably maintained by the direct stimulating effect of the internal secretions upon the peripheral organs or upon the central or peripheral nerve-cells.

That tonus may be augmented from the periphery is illustrated when the skin becomes chilled. Here, the sensory stimulation thus evoked, reacts upon the nerve-centers and

*Reference has already been made to this subject on page 267.

the discharge along the motor paths to the muscles causes the discernible movements of shivering.

It is in this way that one may explain the elicitation of visceral reflexes either by peripheral or central stimulation (vertebral reflexes). We shall also learn in chapter XIII that tonus may be influenced by psychic factors. Let us in our polemic concede that the foregoing holds as far as musculature is concerned. In the aorta, however, the *tunica media* (middle-coat), in comparison with the coat of other arteries, is thicker and contains relatively more elastic and less muscular tissue. In the root of the aorta, this coat consists chiefly of striated muscle (like that of the pulmonary artery), and resembles that of the myocardium with which it is continuous.

The contractility of the aorta, however, is a question of physiology and not histology.

The majority of writers contend that mesarteritis resulting in degeneration of the elastic tissue of the aorta is the predisposing cause of aneurysms.*

Experimental aneurysms result when the wall of an artery is cauterized; the resulting inflammation causing the formation of fibrous tissue without elasticity and the latter being less resistant than an elastic tube, dilatation of the vessel ensues.

In small sacculated aneurysms, a spontaneous cure has been known to occur by thrombosis. In our many successful symptomatic cures of aneurysms, we have not had an opportunity of determining the *rôle* played by thrombosis, hence the doctrinaire must await the verdict of the necropsy. We believe that our results are achieved by increasing the tonicity of the vagus (*vide* chapter XIII), which in reacting on the fibro-muscular coat of the aorta diminishes the

*As will be shown on page 552, the author is not in accord with this view-point.

caliber of the vessel and by augmenting its elasticity makes it more resistant (Fig. 119). The results attained are not unlike the effects on the heart by the methods of Schott. The physiologic excitation of the aortic and other visceral reflexes increases the contractility and tonicity of the aorta and viscera but when the stimulation is excessive, the opposite effect is produced, viz.: dilatation and diminished contractility and tonicity.

PERIPHERAL REFLEX PHENOMENA OF VISCERAL DISEASE.

1. Pain; 2. Hyperalgesia; 3. Muscular Spasm; 4. Secretory reflexes; 5. Vasomotor reflexes; 6. Pilo-motor reflexes; 7. Paravertebral tenderness; 8. Elevation of temperature.

Before consideration is given to the foregoing symptoms attention must be directed to the cerebro-spinal and to the autonomic nervous system* (page 24). The former system including the brain, spinal cord and the peripheral nerves mediates sensation and muscular contraction.

The autonomic system innervates the viscera.

Both systems are intimately associated and afferent impulses passing from the viscera stimulate the nerves of the cerebro-spinal system so as to eventuate in peripheral pain, hyperalgesia and muscular spasm. The autonomic system, according to Langley, is shown in Fig. 101.

*Further discussed in Chapter XIII.

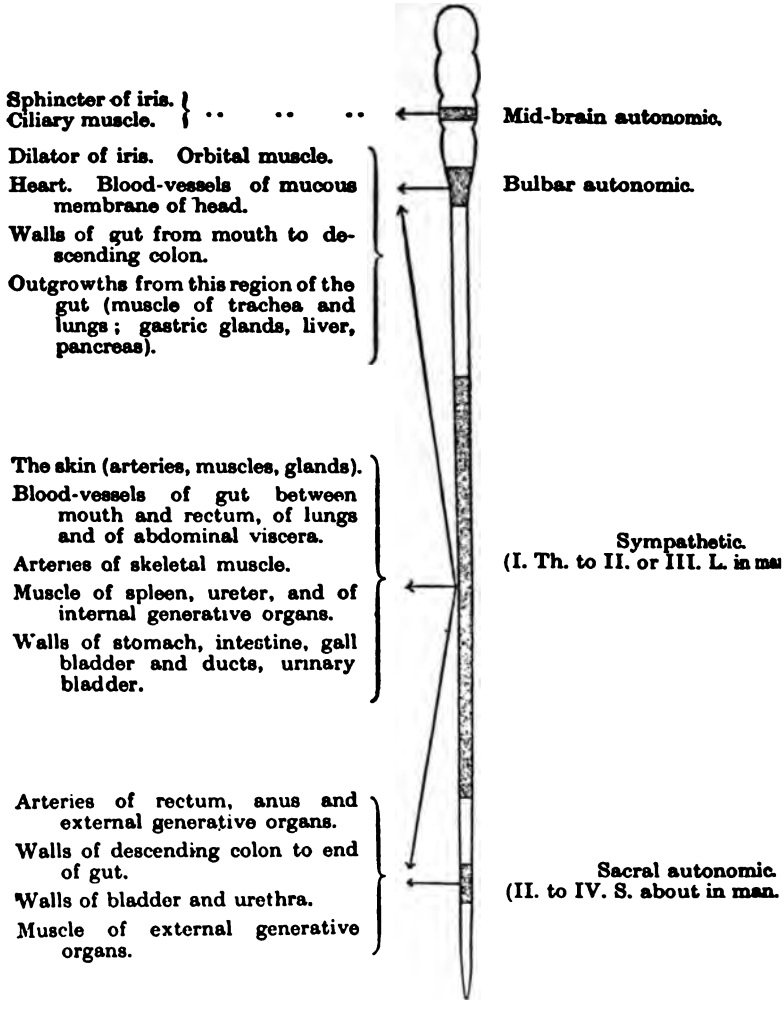


Fig. 101.—Illustrating the origin and distribution of efferent autonomic fib "Muscle," refers to unstriated muscle only and the "walls" of a structure sig the unstriated muscle in them. The innervation of the gastric glands, panc and liver and the arterioles of the skeletal muscles and the central nervous syst is still dubitable.

1. PAIN.—When the cerebro-spinal nerves are stimulated, the pain is referred to the peripheral distribution of the nerve. In many instances, however, the pain is not strictly localized in the irritated nerve itself but it radiates to different areas.

Mackenzie[68] quotes Sherrington, who states that, after applying a mustard leaf over the front of the upper part of the sternum, an unpleasant tingling sensation was experienced above the inner condyle over each upper arm. In explanation of this phenomenon, one knows that the second thoracic nerve supplies equally the upper chest and the inner side of the upper arm and that, when the stimulus from the chest (after application of the mustard plaster) reaches the spinal cord, it affects the adjacent cells. Hence, although the peripheral parts are widely apart, they have a common center in the cord.

This overflow of the reflexes, or what is currently known as *radiation of pain*, is illustrated in daily practice and is often a source of error in diagnosis. Thus, one may cite *abdominal pain*. Palpate the abdomen almost anywhere and the pain is often as keenly felt in one as in another situation. In such instances, the pain without conspicuous associate symptoms may mean an appendicitis, and for that matter, it may just as well be the pain of biliary or renal colic, or if a woman be the subject, pelvic disease. Here the inhalation of chloroform, not to the point of anesthesia, but just enough of it to quiet the patient without affecting consciousness, causes the disappearance of radiating pains, while the original pain remains fixed in the region of the right hypochondrium in gall-stone colic, or over McBurney's point, in appendicitis. Morphin, hypodermatically, accomplishes the same object.

In this connection, I wish to refer to another diagnostic

point. If one is in doubt concerning the organ as the source of pain, palpation or pressure on the implicated organ will reproduce the exact pain about which the patient complains. A fixed pain practically always denotes an organic and not a functional lesion.

In *trigeminal neuralgia*, I have frequently encountered sensitive areas at the side of the 1st and 2nd cervical spines, and freezing of the latter was followed by relief for a variable period of time. This also applies to *odontalgia*. A spinal tract of the trigeminus can be traced as far down as the second cervical segment of the cord. It is also easy to understand vagal-reflexes in consequence of trigeminal irritation; at its cranial end, the vagus is in direct relation with the trigeminus through the intervention of the tubercle of Rolando.

Even under anesthesia, the trigeminus maintains its sensibility and though sensation is abolished elsewhere, punctures in the temples and frontal region are still perceived.

Dr. Geo. Baert, of Michigan, having availed himself of the foot-note suggestion on page 374, employed the treatment successfully in several cases of trigeminal neuralgia, notwithstanding futile results with injections of alcohol.

An overflow of the reflexes is frequently noted in functional disturbances. Thus in *kysterical anesthesia*, there is a temporary restoration of cutaneous sensibility after the use of morphin hypodermatically. In hysteria, one also observes during the stage of chloroform excitation, the disappearance of contractures and other stigmata of the disease. One must not forget that spinal nerves are composite structures and spasm and pain are associated with their irritation. Thus, in *laryngeal stenosis* of children, the use of an opiate excludes the spasmodic element and often makes

a tracheotomy unnecessary. This same practice applies to the introduction of an instrument into the bladder when there is spasm of the vesical sphincter.

VISCERAL PAIN.*—Mackenzie contends that the viscera are insensitive to ordinary stimulation and what is regarded as visceral sensitiveness by the examining physician is merely cutaneous and muscular hyperalgesia. In other words, visceral pains are not felt in the organ, "but are referred to the peripheral distribution of cerebro-spinal nerves in the external body-wall." In support of his hypothesis, Mackenzie cites the following:

1. Pressure exerted over a supposed gastric ulcer, an enlarged liver, or an inflamed pleura, causes pain; but this method of investigation ignores the augmented sensibility (hyperalgesia) of the tissues (skin and muscles) covering the external body-wall.

2. Pain is felt in the position where the organ is situated. If this were true, then the pain would shift in accordance with the location of the organ. Thus, in gastric ulcer even though the stomach is dislocated by deep respiratory movements, the pain remains stationary.

I contend that there is visceral pain *sui generis* but that, it may be associated with pain referred to the coverings of the body-wall connected with the same segments of the spine. The investigations of Mackenzie demonstrate that the viscera are only insensitive to such stimuli as pressing, drying, application of silver-nitrate, burning, cutting, etc., and that, were a definite stimulus employed, visceral sensitiveness could be shown. It is known that a nerve-ending may respond to one form of stimulation and yet prove insensitive to others. Every nerve when stimulated responds

*Reference is made to this subject on pages 58 and 413.

in a manner peculiar to its function. Stimulation of the optic nerve creates the sensation of light and excitation of the auditory nerve responds with the sensation of sound. The recent investigations of Hertz[69] show that tension is the only cause of true visceral pain and that pain originating in the peritoneum* is not uncommon in the absence of visceral pain.

In a patient where the diagnosis of gastric ulcer was definitely established, the skin and muscle in the region of a sensitive point were anesthetized yet, by deep pressure, I succeeded in eliciting the same degree of tenderness as before local anesthesia.

By my method of *transmitted palpation* (page 83), visceral sensitiveness is easily demonstrated. By aid of the vertebral reflexes (page 7), visceral pain may be accentuated or inhibited and the same holds good for segmental analgesia of the viscera (page 376).

The local area of tenderness of visceral origin does shift when the vertebral reflexes are employed (Fig. 85).

2. HYPERALGESIA.—Cutaneous hyperalgesia consecutive to visceral disease has already been discussed (page 58).

Hyperalgesia of other structures, notably the muscles, is equally common. Pressure, to elicit muscular hyperalgesia is faulty, for the reason that one cannot exclude cutaneous hyperalgesia. Here, one may make passive movements, or the muscular tenderness may be evoked by active movements of the muscles by the patient. When the muscular hyperalgesia is associated with spasm, mistakes in diagnosis are not infrequent (page 191).

*Lennander, contended that the parietal peritoneum is intensely sensitive to pain, but not to pressure, heat, or cold and that painful abdominal sensations are transmitted by the phrenic, lower six intercostals, lumbar and sacral nerves (which innervate the parietal peritoneum). The visceral peritoneum and abdominal organs (innervated by vagus or sympathetic), are not sensitive to pain.

3. MUSCULAR SPASMS.*—The term, *viscero-motor reflex* has been applied to the spasm of a muscle in consequence of visceral disease. This reflex is commonly observed in affections of the abdominal viscera (hardness of the abdominal muscles and tenderness which are accentuated by palpation). Muscular spasm as a peripheral symptom of visceral disease, may be manifested by clonic or tonic contraction and involvement of a part or the whole of a muscle. When the part of a muscle is involved, it may be mistaken for a tumor (page 191). In some instances, the viscero-motor reflex in question is only recognized by increased resistance on palpation.

Muscular spasms may persist during deep narcosis and as a rule, they yield last of all the muscles during anesthesia.

Dr. C. A. Reed [70], based on the observations of Nothnagel and Lennander, who insist that visceral pain is only a phenomenon of muscular hyperalgesia, seeks by subduing the latter to relieve visceral pain. Many post-operative pains following operations on the uterus and adnexa have been subdued (even though morphin failed), by deep muscular injections of the following solution into the hyperalgetic areas:

℞	gm. or c.c.
Morphin hydrochlorid	0|01
Novocain	0|04
or	|
Scopolamin	0|0015
Normal salt solution	1|

"This represents a single dose which, before administration, is further diluted with physiologic salt solution to permit of its distribution by numerous deep punctures with an ordinary hypodermatic needle into the hyperalgetic areas.

2. For analgesia, after thoroughly cleansing the integument, all of the mixture is injected into the muscular

*Vide page 46, *et seq.*

layer, several punctures being employed and care being taken to make them at points that approximately define the circumference of the hyperalgetic area. The analgetic effects will be realized within from five to ten minutes, and in consequence of the presence of the scopolamin, will be continued often from six to eight hours, while in some instances they will be permanent.

3. For local anesthesia, the same solution is used in the same way, with the exception that it is discharged into the subcutaneous connective tissue at points that approximately define the circumference of the area that it is desired to anesthetize. The sensibility will disappear in from five to eight minutes and will remain absent for a period varying from an hour to three hours."

Reed argues that, if an algetic impulse can be telegraphed from viscus to muscle, an analgetic impulse can be transmitted from muscle to viscus and thus pain may be controlled. It is true that we know little of autonomic phenomena and are not sure of that but it is reasonable to assume that the analgesic formula before mentioned owes its efficacy to its action on the sensory nerves of the muscle.

It is known that an inflamed joint may be absolutely fixed in consequence of powerful contractions of the surrounding musculature. This condition may suggest a false ankylosis and insomuch as the muscular spasm may persist even during narcosis, I would suggest the use of Reed's formula for releasing the spasm and thus aiding diagnosis.

The author recalls circumscribed spasms of the sternomastoid muscle, which were mistaken for tumors and which were dispersed by a few applications of the Faradic current. Mitchell reported a *phantom tumor* in the left pectoral region.

Despite the irrelevancy of the interpolation, I wish to direct attention to circumscribed tonic spasms of the visceral

musculature. It is known that phantom tumors of the abdomen may be caused either by a contraction of the abdominal muscles or meteorism, and when such tumors occupy the lower abdomen, they simulate pregnancy (*pseudocyesis*). Anesthesia may be necessary to cause their disappearance. To my knowledge, no reference has been made to circumscribed tumors of the uterus mistaken for fibroids and often due, as I believe, to subinvolution of the uterus. These *pseudo-fibromata* may be dispersed by elicitation of the uterus reflex. (page 358).

Dr. M. Turnbull reports the following case:

> "Patient suffers from menorrhagia and profuse metrorrhagia. She is very pale, emaciated and growing progressively weaker. Examination of the blood shows a profound anemia. Has been advised by several prominent gynecologists to have a myomectomy or a hysterectomy performed. All concurred in the diagnosis of an interstitial fibroid. Uterus is enlarged and a *fibroma?* is distinctly palpable. Treatment consisted of eliciting the *uterus reflex* by application of the interrupted sinusoidal current to either side of the second lumbar spine every day for a period of three minutes. At the first treatment, one could observe contractions of the uterus through the speculum and the expulsion of clots of blood from the uterus. After about three weeks treatment, patient was practically cured and has continued so up to the present time of writing. Examination shows a normal uterus and the supposititious fibroid can no longer be palpated. The patient has been cured of a chronic constipation."
>
> (*Comment by the author.*—The patient suffered from atonic constipation (page 328), and the treatment directed toward elicitation of the uterus reflex was equally applicable in this form of constipation. Electricity (Galvanism) has been credited with a selective effect (electrochemic) on fibroids. It is probable that the action is due

to dispersion of irregular contractions of the uterine musculature).

ABNORMAL POSITIONS OF THE UTERUS, caused by relaxed ligaments, may be improved and cured by eliciting the uterus reflex. Some of the ligaments contain non-striped muscular fibers, whereas the round ligaments consist essentially of muscular tissue, prolonged from the uterus.

SEGMENTAL PSYCHROTHERAPY (page 375) is likewise of diagnostic value assuming that one is unable to palpate the abdominal viscera owing to rigidity of the muscles. Reference to the table on page 33, shows the segmental origin of innervation and Fig. 10, the spines corresponding to these segments. If the spines are *thoroughly* frozen, palpation is facilitated. I recall a case where *taxis* was employed without result to reduce an inguinal hernia but when freezing was used in the manner indicated, reduction was effected. In another patient, reduction was effected by refrigerating the hernia.

MUSCULAR RIGIDITY IN THORACIC DISEASE.—In thoracic affections, notably, pleurisy, pericarditis and pneumonia, the pain may be reflected from the chest to the abdomen. The abdominal symptoms are often so fulminant in character as to suggest appendicitis, peritonitis or perforation, and thoracic symptoms are absent or may be overlooked. The abdominal signs consist of tenderness and rigidity of the muscles, abdominal pains and symptoms of collapse. Diagnosis can usually but not always be established by the absence of tenderness over the subjectively painful abdominal region and by a careful exploration of the chest. In differentiation, the use of chloroform as suggested on page 413, may be used.

Pottenger[71] and Wolff-Eisner[72] direct attention to muscular rigidity in thoracic disease. The latter regards light touch-

palpation as valuable in the recognition of pulmonary affections. Pottenger, however, is entitled to the greater credit for having elucidated this sign. He describes two signs:

> 1. Muscle rigidity, which may be defined as a feeling of resistance noted on palpating the muscles which overlie inflammatory conditions affecting the pulmonary parenchyma or pleura due to acute muscle spasm when the inflammation is acute and pathological change in the muscles when the inflammation is chronic.
>
> 2. A feeling of different degrees of resistence noted over organs or parts of organs of different density on "light touch palpation."
>
> The two signs are clearly distinct. Muscle rigidity is confined to the muscles alone, while the difference in resistance found on light touch palpation applies to the density of tissues as found not only in the muscles, but the deeper organs as well, and may be used in outlining either normal organs or areas of disease where such disease produces change in density of any of the tissues which we are able to palpate.

SPASM OF THE ESOPHAGUS, notably its lower end, associated with cardiospasm, is not infrequently of reflex origin and due to hypertonicity of the vagus (page 452).

RIGIDITY OF THE SPINAL MUSCLES.—This subject has already been discussed on page 46 *et seq.* There are, however, conditions remote from the site of the spasm which are related to the latter and interpreted by the patient as *backache.* Such conditions embrace many affections of the lower extremities, specified as rheumatic or neuralgic and which owe their origin to disabilities of the feet. The latter, as offending factors are frequently ignored because the reflex backache is so far removed from the foot. Pains, specified as sciatica are likewise caused by some pedal infirmity. The most frequent condition represented by the latter is the

vigorous rubbing of the infiltrations causes them to swell with accentuation of the pains.

In addition to the treatment suggested on page 90, *fibrolysin* (page 108), may be used by injection into the gluteal muscles. If the treatment is effective, the infiltrations and pain begin to disappear after two or three injections.

The local application of *salicylates* is often of service. An ointment composed of two drachms of oil of wintergreen in an ounce of lanolin may be used, or more costly preparations, known as *mesotan* and *anesthol*.

In intractable cases of fibrositis, inject into each infiltration a few drops of alcohol (85 per cent). Repetition of the injection may be indicated. Disinfection prior to injection may be achieved by painting the skin with iodin-tincture.

Quinin and urea hydrochlorid (soluble 1 in about 1 of water), may be used as an injection (1 per cent. solution). It acts as a local anesthetic (also hemostatic), and the effects last from four to seven hours.

In the author's experience, the most effective means of dispersing the indurations is by diathermy (page 404). The electrodes are applied directly over the infiltrations.

I have frequently found very circumscribed muscular contractions (suggesting myistides), associated with neuralgia of the spinal nerves. Freezing at the vertebral exits of the affected nerves causes an immediate disappearance of the muscular contractions.

4. SECRETORY REFLEXES.—The reflex center for the salivary secretion is located in the medulla oblongata in juxtaposition to the origin of the 9th and 10th cranial nerves. The latter may be stimulated reflexly in visceral diseases, notably in angina pectoris. The same reflex effects are noted with the secretion of urine. Thus, one notes the frequent micturition in appendicitis and the excretion of large quantities of urine after attacks of visceral pain. In a number of instances, the secretory reflexes are mediated through the afferent fibers of the vagus.

5. VASOMOTOR REFLEXES.*—These reflexes are noted

**Vide* page 272.

in individuals in whom there is a maladjustment of the circulatory relations; "a tempermental condition of aberrant motility of the vasomotor system," which is comprehensively designated by Cohen[78] as, *vasomotor ataxia*. The symptoms of the latter may be: 1. Constrictive; blanching or cyanosis of the skin according to whether the venous or arterial system is predominantly affected. 2. Dilative or hyperemic; edema, flushing or cyanosis of the skin. 3. Mixed; the most common form, in which dilatation and constriction alternate, and there is cutaneous cyanosis, mottling, blanching and edema. The foregoing phenomena are not confined essentially to the skin but have also been observed in the eye-grounds and throat.

For a description of the *visceral angioneuroses*, the reader is referred to the original communication of Solomon Solis Cohen[78].

The *vasomotor temperament*, if one may be permitted to so call it, may be recognized by the following signs:

SKIN.—Marbled or mottled skin, intensified by cold and diminished by heat. The cutaneous signs may be limited to a definite region of the body. The hands may assume almost any color but usually the latter runs out upon raising the limb and upon resumption of the natural position, it becomes pink and then passes into purple and blue tints. Spastic blanching is seen in the so-called dead finger. Alternations of blanching and congestion yield the "tattooed" appearance and blue, red and white stripes. Pigmentation of the skin, maculated or diffused, and transient or permanent, is observed in one-third of the cases. Leucoderma is also observed. Perspiration may either be excessive, scanty or absent. Skin-lesions like urticaria, erythema and eczema, are transient and recurrent. When the hands or feet are immersed in hot or cold water, the responses correspond to the norm, although exaggerated.

NAILS.—In nearly every case there is a deep red terminal line—a loop of dilated capillaries.

EYES.—Widening of the commissure, tremulousness of the lids

upon light closure, dilated pupils, pain in the eyes, drooping of the lids, distention or contraction (less common) of the retinal vessels.

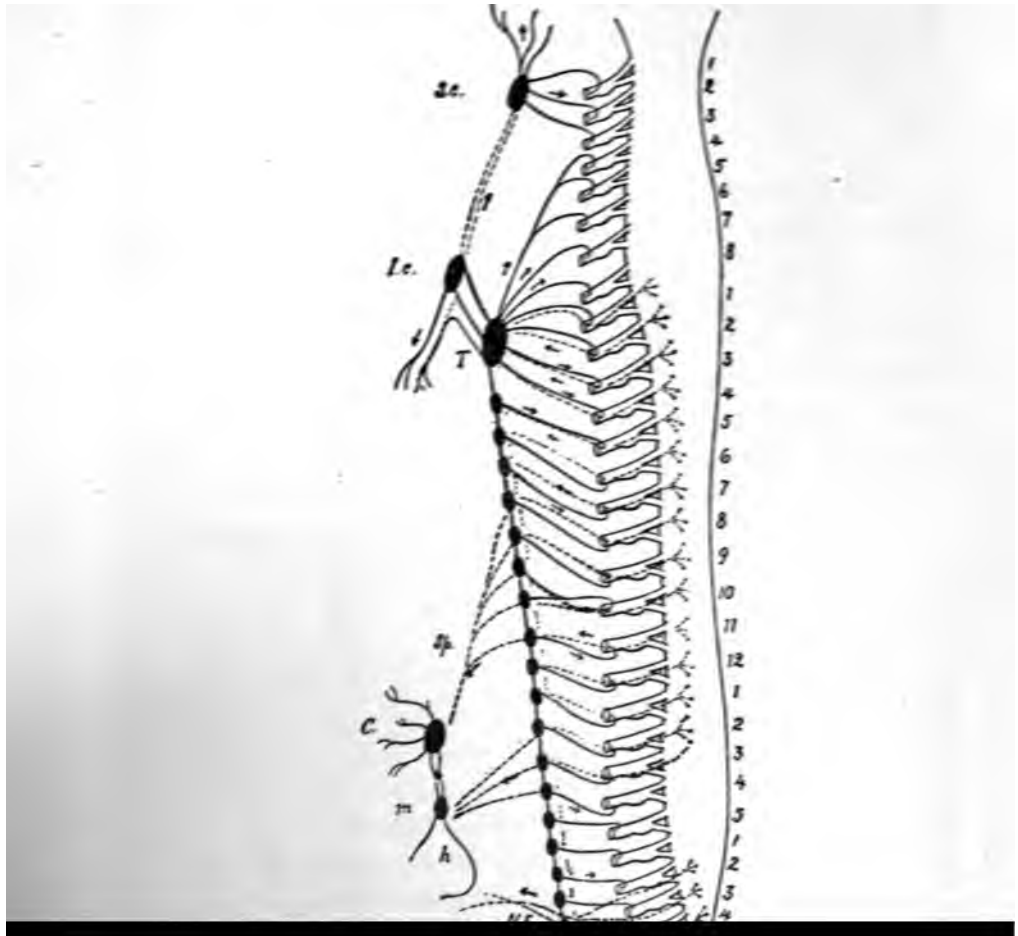
Among other symptoms are: Enlargement of the thyroid gland, irregularity of the heart and tremor of the muscles in some part of the body.

VASOMOTOR REACTIONS.—Insufficiency of the vasomotor apparatus may be present in one region of the body and absent in another. I have essayed to elaborate a few practical reactions which are of great value in diagnosis and treatment. They refer specially to the head, respiratory apparatus and the splanchnic circulation. Only the latter will receive present consideration, reference to the former is made on page 614.

COURSE OF THE VASOMOTOR NERVES.—The relation of the vasomotor nerves to the spinous processes is discussed on page 278, but Fig. 102, from Howell, will give one a more comprehensive idea respecting the course of the autonomic (sympathetic) fibers.

From the vasomotor center, some of the fibers pass directly through some of the cranial nerves to their area of distribution, whereas the others, descend in the spinal cord where they enter into connection with the subordinate vasomotor centers in the cord and then leave the latter, through the anterior roots of the spinal nerves or pass into the sympathetic through the rami communicantes, from which point they attain the blood-vessels to which they are distributed. The following table, by Langley, illustrates the probable relations of the spinal roots to the ganglia of the sympathetic system in man, according to which the chief outflow of sympathetic fibers occurs between the first thoracic and second lumbar roots.

Spondylotherapy



GANGLIA OF THE SYMPATHETIC SYSTEM.

SPINAL-ROOT.	CERVICAL.	THORACIC.	LUMBAR.	SACRAL.
I	Sup. cerv.	.....	.....	.....
II	Sup. cerv.	.....	.....	.....
III	Sup. cerv.	.....	.....	.....
IV	Sup. and inf. cerv.....	.....	.....	.....
V	Sup. and inf. cerv.....	1, 2	.....	.....
VI	Sup. (?) and inf. cerv...	1, 2, 3, 4, 5	.....	.....
Thoracic VII	Inf. cerv....	1, 2, 3, 4, 5, 6, 7, 8, 9	.....	.....
VIII	.....	? 5, 6, 7, 8, 9, 10, 11, 12	.....	.....
IX	.....	? 8, 9, 10, 11, 12	1, 2	.....
X	.....	11, 12	1, 2, 3	.....
XI	.....	12	1, 2, 3, 4	.....
XII	.....	.....	1, 2, 3, 4, 5	1
I	.....	.....	? 2, 3, 4, 5	1, 2, 3
Lumbar II	.....	.....	? 3, 4, 5	1, 2, 3, 4, 5

The ganglia of the sympathetic nervous system are as follows: *Cervical portion*, 3, *Dorsal*, 12, *Lumbar*, 4, and *Sacral*, 4 or 5 pairs of ganglia.

The *cervical sympathetic*, which supplies the majority of the blood-vessels of the head, obtains its fibers from the first to the seventh thoracic roots, all of which terminate in the superior cervical ganglion which is located opposite the second and third cervical vertebrae.

The *upper extremities*, are supplied by vasomotor nerves which terminate in the first thoracic ganglion.

The vasomotor nerves of the *lower extremities* pass through the nerves of the lumbar and sacral plexuses into the sympathetic.

TEST FOR THE SPLANCHNIC CIRCULATION.—Recapitulating certain facts concerning splanchnic neurasthenia (pages 252, 345) we note that it is a condition dependent on intra-abdominal venous congestion superinduced by insufficiency of the splanchnic vasomotor mechanism, and that the *neur-*

asthenic symptoms resulting therefrom may be corrected by by relief of the congestion, and by maneuvers which will increase the efficiency of the liver as an organ of defense.

Toning the splanchnic vasomotor mechanism is the most potential of all methods in the treatment of splanchnic neurasthenia.

It has already been observed on page 346, that when one presses the abdomen, or when the sinusoidal current is applied to the abdomen, the blood is driven from the intra-abdominal veins back into the heart. The latter action is chiefly due to the elicitation of the liver reflex (page 331), which results in a decided reduction in the volume of the liver. Insomuch as it has been estimated that the latter organ contains blood equivalent to one-fourth the amount of blood contained in the body, it is not difficult to conceive that, by contraction of the liver alone, considerable blood may be expressed from the splanchnic circulation.

However, the author finds that it is now possible to influence the latter circulation by direct stimulation of the splanchnic nerves which control the blood-vessels of the abdominal organs.

True, digitalin or strophanthin, alone or in combination, quickly relieve abdominal congestion. They are endowed with the property of constricting the splanchnic vessels alone, whereas digitoxin constricts all the blood-vessels.

However, with pharmaco-therapy only temporary results are achieved, and the latter should be superseded whenever possible by physio-therapy.

Before describing the physio-therapeutic method of the author, it is necessary to advert succinctly to the splanchnic circulation.

The latter properly comprises the arterial and venous

supply to the abdominal organs and is known as the *splanchnic area*. The largest vascular areas in the body are:

1. The splanchnic area;
2. The brain;
3. The muscles;
4. The skin.

The splanchnic area is large enough to contain almost the entire volume of blood of the body.

If the portal vein is tied, practically the entire blood-volume of the body will accumulate in the intestinal and hepatic blood-vessels and, in this way, an animal may be bled into its own veins.

There is an incongruity in an animal like man built on the longitudinal plan. The erect posture of man causes the blood to gravitate into the intra-abdominal veins.

The effect of gravity on the circulation is important. The chief effect of gravity is that the veins become filled with blood in the dependent parts. If an animal is held with its legs hanging down, the amount of blood going to the heart is reduced and the blood-pressure in the arteries is consequently diminished. This hydrostatic effect of gravity, however, is overcome in the norm by constriction of the vessels of the splanchnic area and by augmented vigor of the respiratory apparatus.

If a "hutch" rabbit is suspended by the ears with its legs hanging down, it soon passes into unconsciousness and will, if left in that position, die in about half an hour. What occurs? The blood leaving the brain accumulates in the abdomen of the animal but the deficient tone of its splanchnic vasomotor mechanism is unable to overcome the evil effects of gravity.

If the animal, however, is placed in a horizontal posture

or. if while still suspended, the abdomen is squeezed or bandaged, consciousness is soon restored.

A wild rabbit, owing to its efficient splanchnic vasomotor mechanism, suffers no inconvenience when held in a vertical position.

The SPLANCHNIC NERVES, are the vasomotor nerves of the abdominal blood-vessels and control the largest vascular area in the body.

If the splanchnic nerves are stimulated, the blood-vessels contract, but when the nerves are cut, the vessels dilate.

In the latter case, a large amount of blood accumulates in the abdominal vessels resulting in an anemia of the other parts of the body which may be so great (brain-anemia) as to cause death.

We shall presently learn that the physician can by simple methods either increase or diminish the tone of the splanchnic nerves and, in this respect, he can achieve results tantamount to the vivisectional experimentalist.

The splanchnic nerves are composed of fibers issuing from the spinal cord in the 5th to the 12th dorsal nerves inclusive. The dorsal nerves in question correspond to the spines of the 2nd to the 8th dorsal vertebrae, inclusive.

If the spines in question are sinusoidalized, or better still, struck in succession by means of a plexor and plexi-meter, the cardio-splanchnic phenomenon (page 346) is at once brought into evidence. In other words, the blood is expressed from the abdominal vessels to the right heart. The phenomenon in question is of short duration, hence one must not delay the percussion.

If, in the norm, an individual assumes the recumbent posture for several minutes and is then requested to stand erect, and the physician at once proceeds to percuss the

lower part of the abdomen, he will elicit two areas of dullness as shown in Fig. 103.

The latter areas are usually of short duration and may be dissipated at once by a series of deep breaths or by striking the 2d to the 8th dorsal vertebral spines.

What reasons have we for assuming that the dull areas in question are caused by the accumulation of blood in the abdominal blood-vessels?

1. The areas of dullness correspond to the largest abdominal vessels.

2. They are at once dissipated by deep breathing which facilitates the return of blood from the abdominal vessels to the heart and by striking or sinusoidalizing the spines of the 2d to the 8th dorsal vertebrae. The latter methods stimulate the splanchnic nerves and by thus constricting the vessels of the abdomen send the blood to the heart. Thus it is, that by the execution of the methods in question, the cardio-splanchnic phenomenon is brought into evidence.

3. If a large vacuum cup is applied to the abdomen at a point just above the navel, and the cup is exhausted, two areas of dullness corresponding to Fig. 103, appear.

4. If, in a given individual, the dull areas corresponding to Fig. 103, are elicited by a change from the recumbent to the vertical position, such areas can no longer be demonstrated by change of position if the vertebral spines corresponding to the origin of the splanchnic nerves are previously sinusoidalized or concussed. By the latter method, we have at least temporarily, augmented the tone of the splanchnic vasomotor mechanism, thus inhibiting the gravitation of blood to the abdominal vessels in sufficient amount to elicit dullness.

5. The dull areas may be evoked (although absent) in the erect posture, by sinusoidalization or concussion of the

four lower dorsal spines (9th, 10th, 11th and 12th dorsal vertebrae).

The author has determined empirically that the spines in question correspond to segments in the spinal cord which, when stimulated, will diminish the tone of the splanchnic nerves, thus permiting a large quantity of blood to gravitate into the patulous abdominal vessels.

6. In splanchnic neurasthenics, the patches of dullness are not isolated as in the norm but the dullness is diffused and occupies the entire lower abdomen (Fig.104). With the betterment of the splanchnic neurasthenic there is a corresponding diminution of the dullness on percussion. The dullness in such patients is always more diffused and pronounced when the symptoms of the patient are accentuated, and it is even possible to elicit many of their sensations (vertigo, sinking sensations, lack of energy, etc.) or aggravate them, by concussion or sinusoidalization of the four lower dorsal spines which, as we have shown, practically paralyze the splanchnic nerves, thus causing an increased quantity of blood to accumulate in the abdominal vessels.*

The author, based on an examination of hundreds of cases with reference to the vigor of the splanchnic vaso-motor mechanism submits the following classification:

1. Patients in whom no dullness in the lower abdomen can be elicited when a change is made from the recumbent to the erect posture; a condition which demonstrates an ideal vaso-motor mechanism.

2. Patients in whom a dullness of short duration (lasting about one minute), is elicited (Fig. 103) on change of position; a condition representing an average vaso-motor mechanism.

*The author suggests to the investigator that the dullness of intra-abdominal congestion be utilized as a gauge in determining the action of drugs on the splanchnic circulation.

3. Patients in whom the dullness is diffused (Fig. 104) and persistent (longer than three minutes), after change from the recumbent to the erect position; a condition representing an enervated mechanism.

Fig. 103.

Fig. 103.—Patches of dullness in the norm, when the erect is substituted for the recumbent posture; percussional evidence of the gravitation of blood into the splanchnic vessels by the attitudinal change in question.

Fig. 104.

Fig. 104.—Diffused area of dullness in insufficiency of the splanchnic vasomotor mechanism. Compare with the normal areas of dullness in Fig. 103.

4. Patients in whom the dullness is diffused and persistent in the erect posture without having previously adopted the recumbent attitude. Here, we are confronted with the most accentuated types of splanchnic neurasthenia.

From what has preceded it will be evident that one must not base inferences on false premises. One must assure himself that dullness of the lower abdomen is really dependent on intra-abdominal congestion by execution of the tests already cited. Thus, there will be an augmentation of the dullness if the four lower dorsal spines are concussed or, conversely, the dullness will be dissipated by deep breathing

(in non-aggravated types of congestion) or by concussion of the upper dorsal spines (2d to the 8th).

In the TREATMENT of splanchnic neurasthenia, two methods are available, viz.:

1. Concussion.
2. Sinusoidalization.

Concussion is more efficient than sinusoidalization. Concussion is a mechanic stimulus and, when it is of short duration, it augments the excitability of the nerves, but when prolonged, the excitability is diminished or abolished. It is evident then that, in the application of a séance of concussion, the treatment must be interrupted from time to time.

Mechanic stimuli are only effective when they are applied with sufficient rapidity to produce a change in the form of the nerve-particles.

In the therapeutic elicitation of the splanchnic reflex of vaso-constriction, the only kind of vibratory apparatus which is effective is one giving a PERCUSSION STROKE. The concussion is applied directly to the spinous processes in succession.

The duration of each daily séance should not be less than 15 minutes, but treatment must be interrupted.

Sinusoidalization may likewise be used for exciting the splanchnic reflex of vaso-constriction. The rapid sinusoidal current is employed for this object.

A large electrode is placed over the sacrum, whereas a small interrupting electrode (which permits one to close and open the circuit) is placed in succession over the indicated spinous processes.

The daily séances must be at least of 15 minutes duration, but interrupted.

In concluding this subject, the author wishes to direct attention to the vertebral reflexes in diminishing the volume of the liver which, in splanchnic neurasthenia is invariably enlarged.

Our conventional conception of the liver is that of an organ which is hard and unyielding.

In reality, however, the organ in question is like a sponge; it swells with augmenting, and diminishes in volume with decreasing pressure.

Concussion of specific vertebral spinous processes contracts the liver for the following reasons:

1. Concussion of the 7th cervical spine acts on the general vaso-motor apparatus.

2. Concussion of the first three lumbar spines acts by eliciting the liver reflex (page 331) of contraction.

3. Concussion of the 2d to the 8th dorsal spines, inclusive, acts by constriction of the splanchnic blood-vessels.

In a number of measurements of the liver made in the parasternal line, the author obtained the following results:

1. Size of liver by percussion before concussion, 12.5 cm.

2. Size of liver after concussion of 7th cervical spine, 11 cm.

3. Size of liver after concussion of 1st 3 lumbar spines, 8 cm.

4. Size of liver after concussion of 2d to 8th dorsal spines, 6 cm.

It is evident, according to the foregoing measurements, that, after elicitation of the splanchnic reflex of vaso-constriction (4), the greatest reduction in the volume of the liver is obtained.*

*The essential facts of this subject have been excerpted from the 4th edition of the author's work, *Splanchnic Neurasthenia*, E. B. Treat & Co., New York.

6. PILO-MOTOR REFLEXES.—Stimulation of the pilo-motor nerves causes contraction of the *erectores pilorum*, and the reflex causes the appearance of "goose-skin" (*cutis anserina*). When the muscles (*erectores pilorum*) attached to the hair-roots contract, in addition to the goose-skin, one experiences a chilly sensation which is probably due to vaso-constriction.

Mackenzie[28] observes that, if the skin under the nipple is rubbed with flannel, goose-skin appears over the part

Fig. 105.—Composite diagram of pilo-motor reflexes.

rubbed and extends to the clavicle and to the inner side of the upper arm and forearm. At the same time the pupil dilates. This phenomenon is explained by noting that the dilator pupillae nerve leaves the spinal cord (at a point where

skin is observed over these vertebrae. The results are only approximate. Subdued light must be used. Limited areas of anemia with elevation of hairs are associated with the goose-skin. In other instances, a faint tremor of the muscles may be noted. The pilo-motor reflexes are rapidly exhausted.

7. PARAVERTEBRAL TENDERNESS.—This subject has already been discussed on page 71, *et sequentia*, and I have not modified my views respecting the reason for the tenderness. Certainly it is not a question of congestion, insomuch as cupping to one side of the tender areas only accentuates the vertebral and peripheral areas of tenderness. We associate tenderness with congestion despite the fact that *pain* is often the piteous appeal of a hungry nerve for blood. In several instances, when freezing, which is the sovereign remedy for dissipating tenderness, was ineffective, notably in *intercostal pains*, suspension of the patient (Fig. 116), caused the disappearance of the vertebral and peripheral points of tenderness. Here one assumed, and the results demonstrated the verity of the assumption, that the pains were caused by a faulty posture (*Vide* foot-note, page 186).

8. ELEVATION OF TEMPERATURE.—Rise of temperature consecutive to concussion has already been noted on page 180. Recently, the author has observed the curious fact that *pressure* exerted and maintained for about two minutes with an instrument (Fig. 112) at the vertebral exits of any of the spinal nerves, will also elevate the temperature from .6 to 1.6° F. The mechanic irritation thus evoked, is equivalent to a pathologic irritation caused by visceral disease and manifested by areas of vertebral tenderness.

The fact just cited may explain the elevation of temperature in some conditions. The even temperature of the body is maintained by a thermotactic condition which adjusts the rate of heat-production (thermogenic factor) and heat-radiation (thermolytic factor).

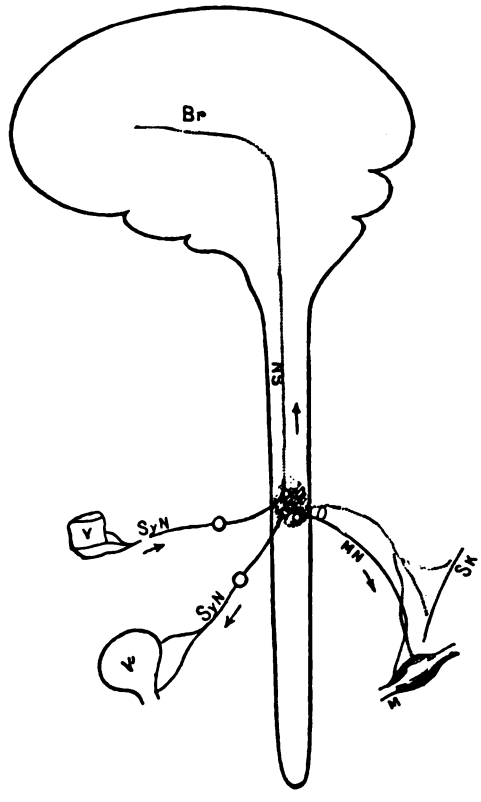


Fig. 106.—Representing the mechanism of visceral pain, cutaneous and muscular hyperalgesia (viscero-sensory reflex), the viscero-motor reflex and the organic reflex. A stimulus from the organ, V, by the sympathetic nerve (Sy. N.), to its center in the spinal cord extends to the adjacent cells of nerves, and excites them to activity, when the function peculiar to each nerve is exhibited. Thus the stimulus affecting the cells of a pain-nerve (SN), eventuates in the perception of pain which is referred by the brain to the peripheral distribution of the nerve in the external body-wall (Sk. M); affecting the cell of a motor nerve (MN), causes a contraction of the muscle (M), supplied by the motor nerve; affecting the cells innervating other viscera (as V'), stimulates them to their peculiar function (contraction of a hollow muscular viscus, increased secretion of a secretory organ). If the stimulus is of sufficient strength, it may leave an irritable focus in the spinal cord (shaded area), as shown by a persistent hyperalgesia of skin and muscle (Sk. M), and by a persistent contraction of the muscle (M).

The relation of the latter factors to thermotaxis may be represented as follows:

$$\text{Temperature} = \frac{\text{Thermogenesis.}}{\text{Thermolysis.}}$$

The impulses of temperature and pain which are intimately associated, enter the spinal cord at the same point and pass into the gray matter.

MECHANISM OF PERIPHERAL REFLEXES IN VISCERAL DISEASE.—Fig. 22 (page 58), illustrates cutaneous tenderness and radiation of pain in visceral disease and Fig. 106, from Mackenzie shows the viscero-motor and sensory reflexes.

IRRITABLE SPINAL SEGMENTS.—Irritable foci in the cord may survive the apparent cure of a visceral disease. This is shown by the persistent areas of vertebral tenderness, the accentuation of physiologic reflexes, persistent dermatomes, reflex muscular contractions corresponding to the irritable spinal segment, and subjective sensations corresponding to the hypersensitive spinal segments. It is not unusual for patients to complain of pains or sensations in definite regions of the body (previously implicated in visceral disease) under emotional influences.

PSEUDO-VISCERAL DISEASES.—It is impossible to exaggerate the importance of this subject which has already been discussed in Chapter VI. *Neuralgia of the spinal nerves is the greatest simulator of visceral diseases.*

A spinal segment is a unit possessed of motor, sensory, vaso-motor, trophic and reflex functions, with regard to the peripheral distribution of the roots of the nerves which emerge from and enter it.

The following case of *pseudophthisis* is cited to illustrate the importance of this subject: A young man was sent to California by his physicians in consequence of a painful and incessant cough. Paroxysmal pains located in the right upper chest were severe. The patient had lost about 20 pounds in weight. The auscultatory evidence on

commonly misinterpreted. It is now possible to demonstrate objectively this overflow of cranial-nerve irritation, and thus eliminate many inchoate data founded on subjective symptomatology.

THE EYE.—Hansell correctly observes: "We have not yet advanced to that stage when we study diseases of the body in relation to ocular defects, and fail to consider diseases of the eye in relation to general diseases," and Helmholtz contended that nature seems to have packed the eye with mistakes, as if with the avowed purpose of destroying any possible foundation for the theory that organs are adapted to their environment.

An ocular defect is one of the most common peripheral irritants in the creation of reflexes, and well-fitting glasses, have frequently achieved the marvelous task of translating a pessimist into an optimist, so essential is correct vision for our condition of well-being.

The following nerves enter into the innervation of the eye and its appendages: 1. Optic nerve; 2. Motor oculi; 3. Trochlear (pathetic); 4. Trigeminus (trifacial); 5. Abducens; 6. Facial; 7. Branches from the carotid and cavernous plexuses of the sympathetic system. The nerves just cited anastomose with the *vagus* (pneumo-gastric) and the upper cervical nerves.

Fig. 108 (from O'Malley[79]), represents a diagram of the ocular nervous system.

The *motor oculi* or third cranial nerve has three sets of fibers. 1. One set supplies all the external ocular muscles (excepting the external rectus and superior oblique) and the levator of the upper lid. 2. A set to the pupillary sphincters. 3. A set to the ciliary muscle (muscle of accommodation).

It is impossible even in the norm to conceive the eye as an organ functionating independently of the other organs.

Reflex disturbances are frequently initiated by refractive errors.

The refractive apparatus is composed of the cornea, iris, lens (adjusted by the ciliary muscle), and the retina. When objects are viewed at a distance of fifteen feet (or more),

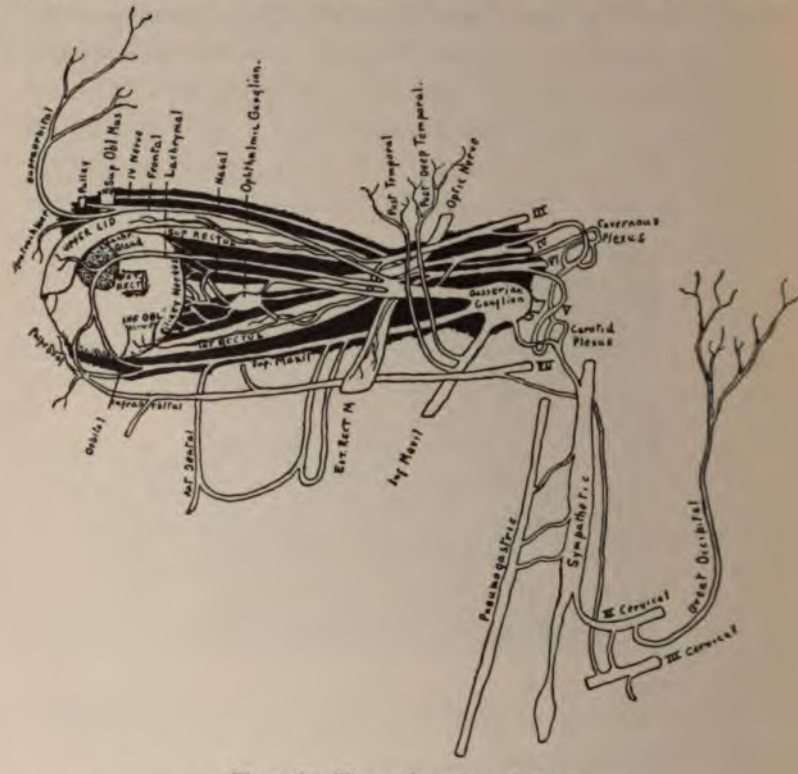


Fig. 108.—The ocular nervous system.

there is a relaxation of the refractive apparatus and it is passive (except the retina) in visualization. In normal accommodation, which is associated with neither fatigue nor irritation, objects near the eye are focused clearly upon the retina by involuntary action of the ciliary muscle which curves the anterior surface of the lens.

In errors of refraction, the brunt of the burden is borne by the ciliary muscle and nerves, thus conducing to their exhaustion and irritation.

Among the reflex symptoms of refractive disturbances are headaches and functional derangements of the heart and stomach. Zimmerman, in a study of 2,000 eye-cases, calculated that over 71 per cent suffered from headache and de Schweinitz, contends that, 60 per cent of all ocular headaches are caused by astigmatism.

I proceeded to study reflex symptoms from ocular anomalies by straining the accommodation of normal subjects and by wearing glasses which caused *asthenopia* (eye-strain due to fatigue of the ciliary or extraocular muscles). After this manner, one could note the development of objective symptoms.

Even in the norm, if one eye of the patient is covered, and the other eye is forced to view an object under strain for a number of seconds, the primary manifestation is tremor or spasm of the cervical muscles on one or the other side (*Vide*, page 124). Later, one or several points of vertebral tenderness develop and areas of sensitiveness may be elicited in the course of the cervico-occipital nerves (midway between the mastoid process and the spine, the sternomastoid and the trapezius, and above the parietal eminence).

While the eye is still under strain, the tonus of the vagus is augmented; the pulse is partially or completely inhibited (best seen in sphygmograms), there is a descent of the lower lung-border, recession of the heart (heart reflex) and the stomach can be percussed. If the eye-strain is continued, the stomach alters its position as in the act of vomiting. In other words, the chief reflex visceral phenomena are mediated by the vagus. Mere pressure on the eye-ball suffices to pro-

voke the *vagal reflexes* but not the reflex sensory disturbances of the cervico-occipital nerves.

In diagnosis, each eye may be tested separately. The signs observed in the norm when accommodation is strained are accentuated and persistent in asthenopia.

By this method of testing, the symptoms from which the patient suffers may be reproduced and, by inhibiting the ocular reflexes (page 443), the diagnosis may be clinched.

Reflex disturbances from the ear and nose are described in the following chapter.

CHAPTER XIII.

TONUS OF THE VAGUS AND PHARMACOLOGY OF THE REFLEXES.*

TONUS OF THE VAGUS—ANATOMY OF THE VAGUS—PHYSIOLOGY AND CLINICAL PATHOLOGY OF THE VAGUS—DIAGNOSIS OF VAGUS-TONUS—VAGUS-TONE AND THE SENSE ORGANS—PSYCHOVAGUS-TONE—METHODS FOR INCREASING AND DECREASING VAGUS-TONE—THERAPEUTIC RESULTS—DISEASES CAUSED BY VAGUS—HYPERTONIA AND VAGUS—HYPOTONIA—PHYLOGENETIC DISEASES—VAGAL HYPERESTHESIA—CLINICAL PHARMACOLOGY.

IN this chapter the author will endeavor to show, how by mere pressure of certain vertebral areas, one may temporarily or permanently inhibit the phenomena of a number of diseases in consequence of the elicitation of definite vertebral reflexes.

The citation of simple maneuvers to attain puissant results does not impugn scientific medicine, on the contrary, it demonstrates the paths of least resistance in combating reflex phenomena.

J. Madison Taylor[88], in commenting on the hand as a therapeutic agent, shows that, "often by clumsy, empirical methods great things are, and greater things can be, thereby done." He proceeds to say, "The body is like a piano or harp, to be played upon at will." He relates how by

*This is regarded by the author as one of the most important chapters in the book, but demands *careful study*. It shows that there are many diseases regarded as distinct affections which are merely symptomatic of a fundamental condition, viz.: hypotonicity or hypertonicity of the vagus. Thus it is that several diseases grow from a common pathogenic trunk.

manual treatment his daughter was promptly cured of a lameness which had resisted the efforts of the best surgeons.

Much in physiotherapy has justly been discredited, owing to exaggerated statements emanating from incompetent sources. Cures mean nothing to the scientist. The author, in the application of his methods, has never been influenced by empiricism alone, and the elicitation of his reflexes to combat disease may easily be demonstrated by anybody reasonably skilled in physical diagnosis.

The subject of *tonus of the vagus* has engaged the attention of the author for years and it is only recently that anything approaching the confirmation of his investigations has appeared.

In a monograph*, which is largely hypothetic, emanating from the von Noorden clinic, an endeavor has been made to demonstrate the relation of the tone of the vagus to other diseases. Insomuch as there is no evidence in this monograph to recognize the tone of the vagus by its effects on the visceral reflexes, the discussion is necessarily theoretic.

Before studying this subject, it is necessary to recapitulate certain facts concerning the vagus.

> ANATOMY OF THE VAGUS.—The tenth or pneumogastric nerve (*nervus vagus*), is the longest and most extensively distributed cranial nerve and contains motor and sensory fibers. The branches of the nerve are shown in Fig. 109.
>
> The vagus communicates with the 9th, 11th and 12th nerves, with the sympathetic, and with the loop between the 1st and 2nd cervical nerves. The following are the *terminal branches:* Meningeal, auricular, pharyngeal, superior and inferior laryngeal, cardiac, pericardial, bronchial, esophageal and abdominal branches.

*DIE VAGOTONIE; Eine Klinische Studie, von Dr. H. Eppinger und Dr. L. Hess. Herausgegeben von Prof. Dr. Carl von Noorden. Berlin, 1910.

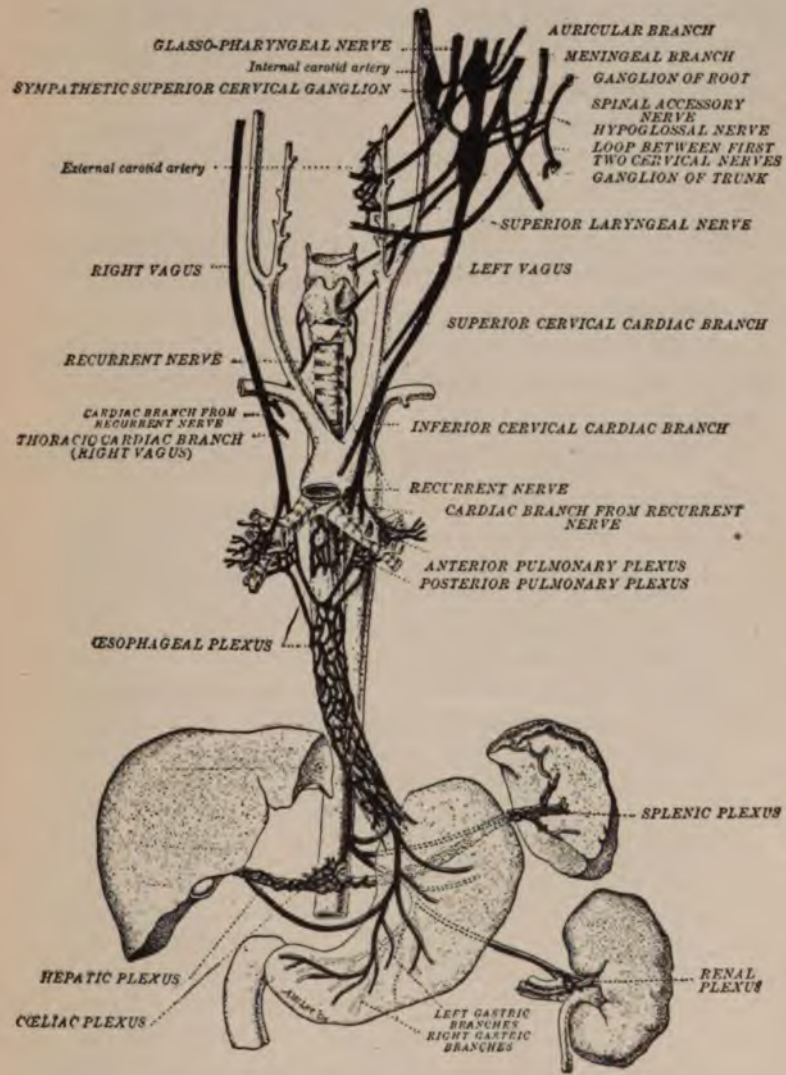


Fig. 109.—Diagram of the branches of the vagus nerves (Morris).

PHYSIOLOGY AND CLINICAL PATHOLOGY OF THE VAGUS.

The nerve is *motor*, for the soft palate, pharynx, larynx, bronchial muscle, heart and abdominal organs. The nerve is *sensory* for the pharynx, larynx, trachea, esophagus and probably the heart.

When the nerve is diminished in tonus (which will be described later), it produces symptoms varying in the motor sphere from hypotonia (page 52), to paralysis and, in the sensory sphere, from hyperesthesia (diminished sensibility), to anesthesia.

Increased tonus of the vagus in the motor sphere is associated with spasms and in the sensory sphere with hyperesthesia.

The following anomalies are associated with individual branches of the vagus:

1. PHARYNGEAL BRANCHES.—The muscles and mucosa of the pharynx are implicated and deglutition is impaired. Spasm of the pharynx is manifested by the "*globus hystericus*," in hysterical subjects and *dysphagia*, in nervous individuals.

2. LARYNGEAL BRANCHES.—Paralysis and spasm of the laryngeal muscles. Spasm is not uncommon in children (*laryngismus stridulus*). Hyperesthesia and anesthesia of the laryngeal mucosa.

3. CARDIAC BRANCHES.—The motor fibers inhibit and control the action of the heart. In hypertonicity, the heart's action is retarded, whereas, in hypotonicity, owing to the uninfluenced accelerator action, all grades of heart-hurry (*tachycardia*) may be present. The sensory symptoms in lesions of these branches include irregularities, palpitation, and other subjective symptoms of cardiac neuroses. In lesions of the vagus, fatty degeneration of the myocardium has been observed, hence the nerve has a trophic function.

The inhibitory action of the vagus on the heart is manifested in controlling the rhythmicity (*chronotropic*

action), irritability (*bathmotropic*), conductivity (*dromotropic*), contractility (*inotropic*), and tonicity.

Blood-pressure is indirectly under vagus-control.

4. PULMONARY BRANCHES.—The motor fibers in a hypertonic state produce spasmodic bronchostenosis (page 311), and asthma, whereas, in a hypotonic condition, they conduce to dilatation of the lungs and emphysema. One knows that the vagus contains fibers which can constrict or dilate the bronchi (page 308). In hypertonia of the nerve, the sensitized mucosa of the air-passages accentuates the cough-reflex.

5. ESOPHAGEAL BRANCHES.—Spasm of the esophagus (*esophagismus*), *cardiospasm* and paralysis. Dysphagia is the essential symptom in these conditions.

6. GASTRIC BRANCHES.—Insomuch as the vagus is the motor nerve of the stomach, it is identified with the motor neuroses of the organ. The vagus also contains secretory nerves for the gastric mucosa, and is therefore associated with the secretory and most probably with the sensory neuroses of the stomach.

Among other functions attributed to the vagus are: Vasoconstrictor fibers for the heart, stomach, intestine, kidneys, spleen, and possibly the lungs; vasodilator fibers for the coronary vessels and the lungs, inhibitory fibers for the cardiac sphincter of the stomach, longitudinal muscles of the small intestine and bronchial muscles, and secretory nerves of the pancreas.

Another important function of this nerve is to maintain the tonus of the thoracic and abdominal viscera.

There are many problems in the physiology of this nerve which have not been solved by the physiologist, hence the aid of the clinician must not be ignored, insomuch as the nature of many diseases is revealed by the remedies employed.

NERVOUS SYSTEM.—This is divided into *cerebro-spinal* and *sympathetic*.

The *cerebro-spinal system* consists of the brain, spinal

cord, cranial and spinal nerves. It supplies the special senses and the voluntary muscles.

The *sympathetic nervous system* (Fig. 101), presides over the visceral movements, controls the phenomena of secretion and influences the caliber of the blood-vessels.

Anatomically, these two nervous systems are with difficulty differentiated, but this difficulty is surmounted by the use of *nicotin*. The function of the sympathetic fibers is inhibited by painting them with nicotin, whereas the same agent is without effect on fibers of the cerebro-spinal system.

The *sympathetic system* is composed of fibers which according to their origin may be divided into cranial, bulbar and sacral (Fig. 101).

1. CRANIAL DIVISION.—This is composed essentially of fibers which pass to the eye through the oculo-motor nerve.

2. BULBAR DIVISION.—The fibers of this division pass through the facial and glosso-pharyngeal nerves and innervate the glands and blood-vessels of the head. The chief nerve of this division is the *vagus*, which is the chief nerve of the viscera.

3. SACRAL DIVISION.—This innervates the structures shown in Fig. 101.

FURTHER DIFFERENTIATION OF THE SYMPATHETIC.—All the nerve-fibers of this system which run into the *gangliated cords of the sympathetic* (Fig. 102), are known as sympathetic fibers, whereas the others are called *autonomic* (page 411), which represent essentially the extended vagus.

These two sets of fibers are physiologically in antagonism; the irritation of one set inhibiting the functions of the other set. Each set shows a definite pharmacologic reaction equivalent to their electric stimulation.

ADRENALIN acts exclusively on the sympathetic, whereas the autonomic fibers are stimulated by PILOCARPIN.

The behavior of atropin is peculiar. It may inhibit the action of other drugs on the autonomic fibers and while its action is most powerful on the cranial division, it is practically without effect on the sacral division.

THE CHROMAFFIN SYSTEM.—This refers to an organ or group of organs made up of certain cells which show a specific staining reaction with the salts of chromium. These cells have the same embryonic origin as the sympathetic nerves and are found with the latter in groups from the base of the skull to the bottom of the pelvis.

The medullary portion of the adrenal glands contains the largest group of these cells from which epinephrin is derived.

There is an intimate relation existing between the thyroid and pancreas and the chromaffin system.

TONUS OF THE VAGUS.—What has been said on page 409, respecting the tone of muscles applies with equal cogency to the viscera. In health, the viscera are in a state of tonicity, *i. e.*, their musculature is in a more or less permanent although variable condition of contraction. Physiologists give us little information concerning the factors controlling visceral tonicity, although they admit that the function is most important in regulating the cavities of the heart and other organs.

The sympathetic fibers are stimulated experimentally by *adrenalin* (sympathicotropic action), and the tonus of these fibers in the organism is maintained by the constant secretion of adrenalin and other products (epinephrin, suprarenalin), from the adrenal bodies. A similar internal secretion has not yet been demonstrated for maintaining the tonus of the autonomic fibers, although we know that such physiologic action can be exhibited by pilocarpin (vagotropic action).

It has been shown that the pancreas has an inhibitory

influence on the secretion of adrenalin and that after extirpation of the pancreas, adrenalin is increased. When the adrenalin secretion is augmented, the reflexes of the sympathetic fibers are increased, and conversely, diminished when the secretion is reduced. The pharmacologic excitation cited, is analogous to what occurs when the sympathetic fibers supplying the iris are cut, viz., pupillary contraction and dilatation of the pupil, when the autonomic fibers are divided.

In the norm, when an adrenalin solution is dropped into the eye, no dilatation of the pupil ensues, but in *diabetes*, with pancreatic involvement, such instillation causes mydriasis. In diseases of the pancreas, the inhibitory influence of the pancreas on adrenalin secretion is checked. When the sympathetic and autonomic fibers are equally stimulated, we have what is known as *tonic innervation*.

In my experimental and clinical work, I have concerned myself chiefly with the tonus of the vagus and clinical pictures have been evolved which are identified either with a diminution of vagus-tone (*vagus-hypotonia*), or an augmentation of tone (*vagus-hypertonia*). Variations in vagus-tone may involve the entire nerve, or it may be confined to one or more of its individual branches (*Local* vagus-hypotonia or hypertonia).

Humans, like animals, show variations in vagus-tone. Thus in some animals, section of the vagus (vagotomy), will produce tachycardia, whereas in other animals no such action is observed. The vagus is more active in middle life than in old age, and least active in infancy.

In some humans, infinitesimal doses of atropin (which inhibit vagus-impulses), will produce tachycardia, mydriasis, glycosuria, etc., whereas in others large doses of the same drug produce scarcely any effects.

DIAGNOSIS OF VAGUS-TONUS.—1. Pharmacologic methods. 2. Paravertebral pressure. 3. Therapeutic results.

1. PHARMACOLOGIC METHODS.—Insomuch as *adrenalin* acts exclusively on the sympathetic, and *pilocarpin* on the autonomic fibers, adrenalin will ameliorate symptoms caused by augmented vagus-tonus, whereas pilocarpin will increase them.

If one concusses the first three lumbar spines to produce the *stomach reflex of contraction* (page 316), one finds that, after an hypodermatic injection of 8 minims of a solution of adrenalin chlorid, 1:1000, the stomach instead of contracting as in the norm, dilates (stomach reflex of dilatation). Thus, before concussion of the spines in question, the stomach retracted 2½ cm., whereas after the injection, it dilated 2 cm.

After an injection of pilocarpin, the stomach reflexes are accentuated.

Thus,

Stomach reflex of	contraction			before injection,	3	cm.
"	"	"	"	after	"	5 cm.
"	"	"	dilation	before	"	2 cm.
"	"	"	"	after	"	3.8 cm.

Atropin paralyzes the motor endings of the vagus. An injection of 0.001 gm. (gr. 1-60), of the latter drug will manifest its action within thirty minutes and disappears in from one to three hours. During the full physiologic action of the drug, *the stomach reflexes are abolished.*

Atropin may thus be utilized in excluding any augmented irritability (hyperkinesis) of the vagus-endings in the stomach. Thus the motor neuroses of the organ (supermotility, peristaltic unrest, gastric crises, spasm of the cardia, and pylorus, etc.), must yield to an adequate dose of atropin. An injection of pilocarpin will, on the contrary, accentuate the motor neuroses.

A *gastric ulcer* will simulate many gastric diseases.

In suspected ulcer, a drachm of salt in a glass of water, ingested on an empty stomach will excite an attack of pain.

Hydrogen peroxid, used for the same object, causes a burning sensation.

Orthoform (8 grains), in one ounce of hot water will only arrest the pains of an abraded surface (ulcer).

If the gastric pain is caused by hyperesthesia due to hydrochloric acid, 10 drops of the dilute acid ingested while fasting causes epigastralgia, which is relieved by sodium bicarbonate.

Rinsing out the stomach with a 1 per cent. solution of glacial acetic acid closes the pylorus, and if there is a positive reaction of blood in the syphoned fluid, it speaks for a gastric in lieu of a duodenal ulcer.[97]

The *heart reflex* (page 199), is abolished by atropin and accentuated by pilocarpin. Thirty minutes after an injection of pilocarpin (gr. 1-10), the heart reflex measured 4 cm., after irritating the precordial skin, whereas before the injection, like irritation elicited a reflex measuring 2 cm.

In several instances when it was impossible to elicit the heart reflex, the latter could be demonstrated after an injection of pilocarpin.

The majority of cases of *heart-block* (Adams-Stokes syndrome), are caused by lesions of the auriculo-ventricular bundle, but there are also neurogenic forms due to vagus-hypertonia. Atropin, which paralyzes the vagi, removes the block in the neurogenic, (pulse-rate becomes rapid), but not in the myogenic forms. Atropin increases the pulse-rate in *bradycardia* due to direct or reflex excitation of the vagus. Aconite tincture slows the heart by vagus-stimulation and if it slows the pulse in *tachycardia*, vagus-hypotonia is present.

Vagus-stimulation not only slows the heart-rate, but creates irregularities in rhythm. If this vagus influence

is eliminated by atropin and *arrhythmia* disappears, the neurogenic nature of the irregularity is demonstrated.

One may physiologically block a host of reflex cardiac anomalies by an adequate dose of atropin. Thus, a case of angina pectoris vasomotoria may be cited with the following signs: heart symptoms, chest-pressure and fear ensuing from exposure to cold. Here, the peripheral vasoconstriction due to cold by increasing blood pressure stimulates the depressor nerve, which in turn by acting on the vagus causes cardiac signs. By paralyzing this physiologic chain with atropin, the hands may be dipped into ice-water without subsequent symptoms, but the latter reappear after the effects of atropin have evanesced.[88]

The *lung reflexes** (page 294 *et seq.*), are mediated by vagal action. Thirty minutes after an injection of atropin (gr. 1-60), both lung reflexes are absolutely abolished.

It is well known that small doses of pilocarpin are almost exactly antagonistic in their action to atropin, and this applies in all cogency to their action on the vagus.

After an hypodermatic injection of pilocarpin (gr. 1-10), one may note an exaggeration of both lung reflexes.

Thus, before the injection of pilocarpin, the lower lung-border posteriorly could be made to descend (lung reflex of dilatation), 4 cm. after cutaneous irritation, whereas, after the injection, the border in question descended 7 cm.

*In a recent work by Leonard Hill (*Further advances in Physiology*), the following obscure observation is made: "Even now most medical writers ascribe the reflex contraction of the lung (Abrams' reflex), which follows any stimulation of the chest-wall to the action of the bronchial musculature. It is more probable that the retraction of the lung is due to a reflex contraction of the musculature of the body-wall." Misconception concerning the lung reflex is due to the failure to recognize *two* distinct lung reflexes and to properly interpret their rationale.

The lung reflex of contraction before the injection lasted 20 seconds, whereas, after the injection, it lasted fully one minute.

After an hypodermatic injection of 8 minims of a 1:1000 adrenalin chlorid solution, the following phenomenon was observed: *After cutaneous irritation, the lower lung border instead of descending as in the norm* (lung reflex of dilatation), *receded from 2 to 4 cm.* In other words, cutaneous irritation elicited the lung reflex of contraction in lieu of the counter reflex of dilatation.

If one accepts the prevailing opinion that, *asthma* consists essentially of a spasmodic constriction of the bronchioles, then an appropriate dose of atropin which paralyzes the bronchial musculature through its action on the motor endings of the vagus, must invariably inhibit an asthmatic paroxysm.

Here, the action of atropin, as some assume, is not caused by a dilatation of the bronchi, because the action of the drug is to paralyze the dilator as well as the constrictor fibers of the bronchial musculature.

Atropin in sufficiently large doses is one of the most satisfactory drugs in asthma, and aside from its action in inhibiting bronchospasm, it diminishes secretion, reduces the sensitiveness of the mucous membranes to reflexes, and stimulates the respiratory center.

Now, as a matter of fact, all asthmatic paroxysms do not yield to atropin, hence one is constrained to conclude that bronchospasm is not the invariable concomitant of asthma. There may be a hyperemia of the bronchial mucosa analogous to urticaria, a swelling of the same mucosa, or, even an exudative bronchiolitis.

Determining the tonus of the lung reflex of contraction is an important test in differential diagnosis. In asthma due to a defective bronchial musculature, the lung reflex of contraction cannot be elicited.

A supposed spasmodic factor in the pathology of pulmonary diseases must yield to atropin, and in this sense atropin is of diagnostic-therapeutic value.

Adrenalin chlorid (in doses from 8 to 15 minims hypodermatically of the 1:1000 solution), is one of the most efficient agents in inhibiting an attack of asthma.

The action of this drug was discovered by Kaplan and Bullowa, and it may truly be regarded as a specific in arresting many paroxysms of asthma.

As noted by the investigations of the writer, adrenalin chlorid evokes the lung reflex of contraction which permits the longitudinal fibers of the bronchial musculature to expel the residual air imprisoned by the spasm of the circular fibers.*

It is furthermore evident that, in our employment of drugs in the treatment of asthma, it is irrational to combine atropin and adrenalin in the same prescription.

The *aortic reflex of contraction* is controlled by vagus-tone. The aorta contracts in proportion as the tone of the vagus is increased.

Reference to Fig. 110, shows the effects of pilocarpin (which increases vagus-tone), on an aortic abdominal aneurysm, and although I have never found it necessary to employ this drug in the treatment of aneurysms, it will aid the physio-therapeutic methods as a synergist, should one encounter cases resistant to treatment.

Atropin will inhibit the aortic reflexes.

The effects of adrenalin on an aneurysm of the abdominal aorta are shown in Fig. 111. This drug dilates an aneurysm of the aorta.

While it is true that the majority of vessels are constricted by adrenalin, the effect is not uniform. Even in the norm, dilator effects have been noted.

The physiologic tonus of the vagus is dependent on the *thyroid secretion.* When the latter is diminished (hypothyroidism), symptoms of cardiac weakness may be present,

**Vide,* the spasmo-paralytic hypothesis of asthma (page 308).

but it is usually an increased secretion (hyperthyroidism), which diminishes vagus-tone. As a rule, in hypothyroidism,

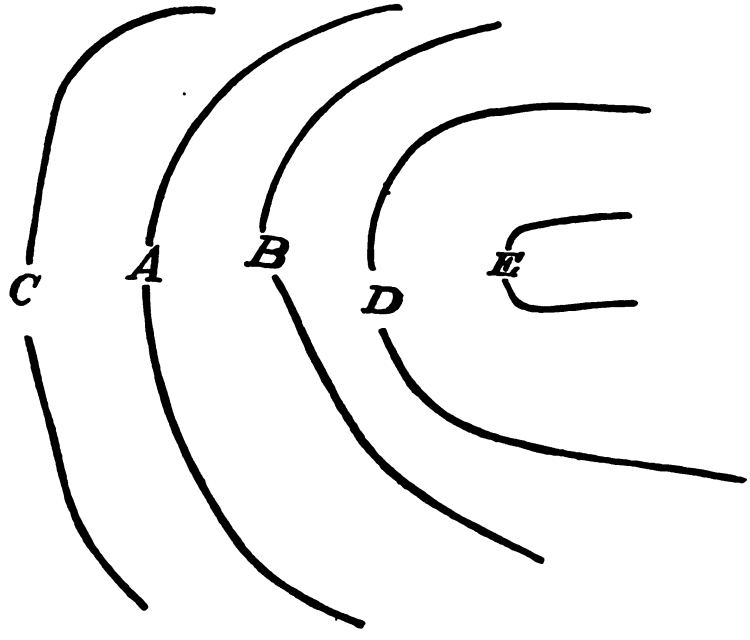


Fig. 110.—Illustrating the effects of an hypodermic injection of pilocarpin (gr. 1-10) on an aneurysm of the abdominal aorta. A, outline of aneurysm by percussion before injection; B and C, aortic reflexes of contraction and dilatation before injection; D, contraction of aneurysm by the action of pilocarpin unaided by the elicitation of the aortic reflex. The degree of contraction extends from A to D. E, the degree of contraction of the aneurysm after the use of pilocarpin aided by the aortic reflex of contraction (extent of reflex from D to E).

the use of thyroid extract by ameliorating certain symptoms, is diagnostic. In hyperthyroidism, antithyroidin or the antiserum of Beebe, may improve the condition. It is well to know that the cardiac signs of Basedow's disease are accentuated by ten 5-grain doses of a reliable thyroid preparation. Iodothyrin or iodin will act in the same way and intolerance to iodin is an early sign of hyperthyroidism.

My investigations show that, even in the norm, reduction in the vagus-tone may be demonstrated after a few doses of thyroid extract by methods described on page 469.*

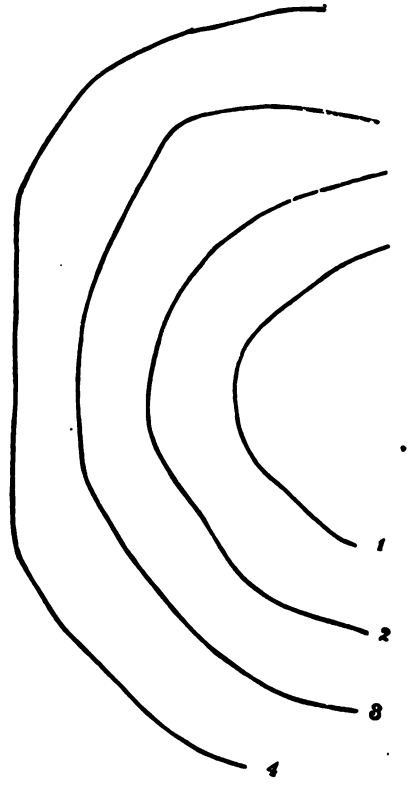


Fig. 111.—Illustrating the effects of an hypodermic injection of 8 minims of adrenalin chlorid (1:1000) on an aneurysm of the abdominal aorta. 1, area of aneurysm by percussion before the injection; 2, aortic reflex of dilatation before the injection; 3, area of aneurysm by percussion after the injection which persisted for an hour; 4, aortic reflex of dilatation after the injection.

*In *phthisis*, the author has found the vagus to be in a condition of hypertonicity as far as the pulmonary branches are concerned and he has used thyroid extract (with poor results) in reducing such tonicity. Thus, in one patient, before giving the extract in five grain doses thrice daily, the lower lung-border descended 5 cm. (after pressure on either side of the 7th cervical spine). After the first day, it descended only 2 cm., on the second day, 1 cm., and on the third day, .6 cm.

Inaccuracy of thyroid medication is due to variations in the iodin-content of the different preparations on the market and to the fact that the weight of the tablets is based on different standards. If the preparation is reliable, it will be shown by the progressive immobility of the lower lung-border after vagus-stimulation (page 459). The latter test is so simple and reliable that the author suggests as a field for pharmaco-clinical research, the action of different drugs on vagus-tone.

Bromids reduce the excitability of the motor area in the cerebral cortex and they also act on the motor and sensory columns of the cord by reducing their motor and sensory conductivity. They reduce all vagal reflexes and are valuable in diagnosis.

To get the effect of bromids, or for that matter, any other drugs, we must push them to saturation, until the border-line of toxicity and physiologic action is reached. In the use of bromids we have attained our object for diagnostic or therapeutic purposes when the palate reflex is lost. The *pharyngeal reflex* may even be abolished in the norm, hence this reflex is only of value if tested prior to the administration of the bromids. When the period of intoxication with bromids is reached, there is mydriasis and loss of pupillary reflex to light and accommodation. *Nervous dyspeptics* show improved digestion after bromids have been used in large doses for several days. This therapeutic test enables us to differentiate gastric symptoms dependent on lesions of the viscus from those caused by an exhausted nervous system.

High blood-pressure is often maintained as a result of augmented tonus of the vasomotor center and is quite independent of vascular disease. It is essentially a nervous phenomenon and usually due to psychic stimulation (*psychogenic hypertension*). Such cases do not respond to the author's method of concussion (page 249), but yield to bromids, as indicated on page 247.

H y p e r t e n s i o n

Respecting ***hypertension***, the author finds that better results are achieved by concussing the region between the *third and fourth dorsal spines*, in lieu of the second and third dorsal spines as described on page 247, when the high blood-pressure is not associated with cardiac insufficiency. Hypertension is mediated by the vagus and pressure at the point indicated diminishes vagus-tone and augments the quantity of blood in the splanchnic vessels. The latter may be demonstrated by the areas of dulness on the abdomen (*vide* Fig. 103), sequential to pressure. Concussion of the *four lower dorsal spines* will likewise cause the areas of abdominal dulness (Fig. 103), but if pressure is executed synchronously at the 7th cervical spine (which increases vagus-tone), no areas of dulness can be elicited. This shows that the centers of the cord corresponding to the four lower dorsal vertebrae are subsidiary to the dominant influence of the vagus.

Dr. H. C. Sawyer contributes the following report concerning a case of hypertension: "Woman, 60 years of age, blood-pressure 210 mm., reduced to 160 mm., after several months treatment at a sanatorium. When treatment by concussion was commenced pressure was 180 mm. Treatment by concussion thrice weekly reduced pressure to 138 mm., and below, and has continued so over a period of several months.

The author again emphasizes the fact referred to on page 248, *viz.*, that in hypertension caused by a failing heart, reduction in pressure can only be achieved by concussion of the 7th cervical spine.

All *emotions* directly influence the heart and the caprices of the organ with its protean symptoms may be subdued by bromids. Any neurosis embraces the entire field of pathology and this applies in all cogency to the heart.

Rest and a few doses of morphin are capable of completely altering the picture of a cardiac disease.

VAGUS-TONE AND THE SENSE ORGANS.—If both nostrils are firmly packed with cotton one may excite the vagus reflexly through the trigeminus. Reference to this fact has already been made on page 297. Even though a paroxysm is not excited, one may auscultate after the cotton-test, the *râles* peculiar to asthma.

It is only recently, however, that the writer has noted that the hypertonicity of the vagus thus elicited includes practically all the branches of the vagus. Like results follow firm pressure on the posterior part of the external auditory meatus (supplied by the auricular branch of the vagus).

If one cocainizes both nostrils (5% solution suffices in the norm), one observes the following:

1. Inhibition of the *visceral tone* (page 451), of the liver, spleen and heart.
2. Inhibition of the stomach reflex and the lung reflex of dilatation. The lung reflex of contraction and the heart reflex persist.

With these facts at our command, one need no longer equivocate with specious hypotheses in explanation of the reflexes of the cranial nerves (page 440).

> The nose is a very important reflex center and must be examined as a routine measure in determining the etiology of many diseases of vagal origin. All kinds of reflex disturbances including headaches, neuralgias, chorea and even epilepsy, may be due to a nasal anomaly and by treatment of a naso-pharyngitis, deflection of the septum, enlarged turbinates, etc., it is possible to cure many disturbances. Reference has already been made to the diagnosis of *emphysema* by aid of cocain (page 297). *Asthma* is often of nasal origin and paroxysms may be inhibited by saturating pledgets of cotton with a 10 per cent. solution of cocain and then introducing one into

each nostril. If relief is obtained, one should determine from which side of the nose the paroxysm is excited. If, for instance, after cocainization of the right nostril, the paroxysm persists, and desists only after its application to the left nostril, one is occasionally justified in concluding that the attack is provoked by some abnormity of the nostril on the left side. One must not forget, however, that mild attacks of asthma may be annihilated by cocain to the nostrils despite the fact that there is no asthmogenic nasal area. Here we recall the fact that cocain anesthesia of the nose inhibits the lung reflex of dilatation without influencing the counter-reflex of contraction. It is the exaggeration of the latter reflex which determines the jugulation of a paroxysm. When adrenalin arrests a paroxysm it does so by stimulation of the bronchoconstrictor fibers (page 457), and cocain (which is less efficient), acts by inhibiting the tonus of the bronchodilator fibers, thus enabling the antagonistic fibers to have unopposed sway. One may provoke sneezing, cough, dyspnea or an asthmatic paroxysm, by touching different parts of the nasal mucosa with a probe. Such areas cauterized with chromic, trichloracetic or glacial acetic acid may prove curative.

The following are susceptible areas of the nasal mucosa: 1. The anterior portion of the septum; 2. The anterior end of the inferior turbinate. 3. Lateral wall of the nose slightly above the region of the anterior end of the middle turbinate; and 4. Upper part of septum about the tubercle.

Irritation of the mucosa of the nasal septum opposite the middle turbinate bone will evoke an *arrhythmia* of vagal genesis. Here the irritation is conveyed, indirectly, to the vagus by the trigeminus.

If the nasal mucosa has been cocainized its irritation by a probe will not evoke arrhythmia.

According to the theory of Fliess, *dysmenorrhea* is often associated with nasal affections. He determines such asso-

ciation by noting whether the pains are influenced by cocainization (10 to 20 per cent.), of the nasal mucosa. Fliess further observes that when the hyperesthetic areas in the nose are irritated with a probe, the pains of dysmenorrhea can be provoked. The latter observation was made by Fliess to contravene the assumption of others, that his results were due to suggestion in hysterical subjects, and that equally good results could be obtained if the cocain were applied to the cervix, rectum, or some other mucous surface.

My observations show that the proponent and his opponents are equally right and wrong. If one first elicits the reflex of the uterus (page 358), in a normal subject and then cocainizes the nostrils with a 5 per cent. solution of cocain, the uterus reflex cannot be provoked during the action of the cocain.

> Furthermore, cocain-anesthesia of any other mucosa is equally effective in abolishing the uterus reflex. In other words, anesthesia of a peripheral area diminishes vagus-tonus. When Fliess excites dysmenorrheal pains by probing the nose, he merely augments vagus-tone.
>
> When cocain solution (5%) is instilled into the eyes all the vagal reflexes are temporarily abolished.
>
> We can now understand why Koblauck finds that nasal cocainization will temporarily inhibit *labor pains*, and that applications of adrenalin will excite them.
>
> Siegmund finds that *gastric pains* are inhibited by the nasal application of a 20 per cent. solution of cocain, which he considers diagnostic and he likewise establishes by the same diagnostic-therapeutic method, the relation between the nose and the genito-urinary apparatus (*enuresis and masturbation*).
>
> It will be evident to the reader, from what has preceded, that the method of nasal cocainization proves nothing. It is only one of the many methods for diminishing vagus-tone. By cocainizing the urethra, I find that one can inhibit the various visceral reflexes.

As we shall learn later, diminished vagus-tone may be effected by paravertebral pressure (page 467), and, after this manner, it is my routine practice to inhibit the motor and sensory reflexes of the vagus.

The foregoing observations of the author lead one to a consideration of the interesting physiologic problem, *viz.*, whether the doctrine of specific nerve energies applies to the muco-cutaneous nerves, *i. e.*, whether there are specific nerve fibers giving only their own quality of sensation. This view is supported by Donaldson, who found that when cocain is applied to the nose or throat, the senses of pain and pressure are destroyed, leaving those of heat and cold.

My observations show a very important clinical fact, *viz.*, *that there are specific muco-cutaneous nerves which preserve the tone of the viscera and that others exist which, when irritated, diminish visceral tone* (page 544).

The facts thus elicited by clinical physiology must substitute the observations of the physiologist. Visceral tone is therefore the resultant of not one, but of a summation of peripheral sensory stimuli, and that the continuity of tone may be blocked by annihilation of a single stimulus.

It is for the foregoing reason that one is able to confirm the observations of Kast and Meltzer (Foot-note, page 58).

There is yet another observation to which attention should be directed, *viz.*, that after nasal cocainization, in lieu of a uterus reflex, one elicits a powerful reflex contraction of the vaginal walls (*vaginal reflex*). This latter observation may be utilized in toning relaxed vaginae. Here the sinusoidal current is used at the same site for elicitation of the uterus reflex.

In concluding this interesting subject of nasal reflexes, let us recall the practical fact that, *impaction of the nares with cotton will accentuate or provoke symp-*

toms of problematic nasal genesis, whereas nasal cocainization will inhibit them.

The pharmacology of the ocular reflexes is discussed elsewhere, (page 498).

PSYCHOVAGUS-TONE.—Psychic influences on the heart and lungs have been discussed on page 203, and it is important to demonstrate such influences objectively. Reduction of vagus-tone may be of psychic origin. Physiologic experiments show that in fatigue of the nervous system, the nerve-cells, which in health are plump, large, and with easily demonstrated nuclei, become small and shrunken and the nuclei indistinct. In consequence of this enervation of the nervous system, reflexes are with difficulty elicited and cure protracted.

The author recalls a patient with a thoracic aneurysm referred to him by Dr. A. J. Minaker. Within a few treatments such cases show amelioration, but in this case the final beneficial results were delayed by grief following the death of a member of the family. Here, it was noted that during the period of grief, there was a considerable reduction of vagus-tone.

Another factor is involved in psychic influences. *Splanchnic stimulation* increases the content of epinephrin in the blood and adrenal secretion is under the control of the sympathetic system. There is reason to believe from the investigations of Cannon and De La Paz[84] that emotional excitement stimulates adrenal secretion. It is evident that when the sympathetic is stimulated, the tonicity of the vagus is reduced. Emotional disturbances conduce to symptoms suggestive of vagus-depression and sympathetic irritation; aortic-dilatation, inhibition of the gastro-intestinal apparatus, rapid heart, etc. I have often been impressed with the inconsistency of our conception of *hysteria* as a disease in which the *will* controls the body and produces morbid changes in

its functions. The fact is, the symptoms of the disease are caused by stimulation of the sympathetic system and the latter is not under the influence of the will. It is equally inconsistent to ask such patients to control their symptoms by exercise of the will.

2. PARAVERTEBRAL PRESSURE.—We have shown under the preceding caption that *pilocarpin*, increases vagus-tone and that *atropin* annihilates it. That *adrenalin*, by stimulating the sympathetic fibers, puts the latter in a state of increased tonus, thereby resulting in a relative reduction of vagus-tonus.

We shall now endeavor to show that augmentation and reduction of vagus-tonus may be obtained in a simplified and more expeditious manner by paravertebral pressure. The excitation of visceral reflexes by spinal pressure has already been noted on page 169.

The points of exit of the spinal nerves are relatively superficial. Thus in a number of measurements, I found the exit at a point corresponding to the 7th cervical vertebra to be at a depth of 2.6 cm. (approximate only), almost in a direct line with the corresponding spinous process and the distance between the two exits corresponded to an average width of 2 cm.

At the first lumbar vertebra, 4.5 cm. represented the depth and 5 cm., the width of the exits on either side.

For making pressure I employ the simple apparatus shown in Fig. 112. The prongs of the instrument are separated by a distance of 5 cm. *If one makes pressure* (the prongs approximating the intervertebral foramina on both sides), *at a point corresponding to the seventh cervical spine, vagus-tone is increased and decreased or abolished when pressure is applied at a point between the third and fourth dorsal spines.* Pressure is maintained for about one minute.

The author assumes that at the former point, the pressor, and at the latter situation, the depressor fibers of the vagus are stimulated (page 232.)

Fig. 112.—The instrument with two prongs (*Radicular pressor*) is employed in diagnosis and treatment for making bilateral pressure on the roots of the spinal nerves at their exit from the intervertebral foramina. The instrument with a single prong is used for demonstrating areas of paravertebral tenderness (*vide*, page 66).

The *depressor nerve* is the most important centripetal nerve of the heart, and while existing as a separate anatomic structure in warm-blooded animals, its homologue has been

traced in the human with central connections in the vagus and endings in the walls of the ventricle.

Fig. 113 shows the origin of the depressor nerve in the rabbit.

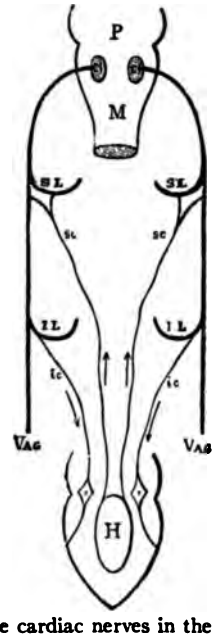


Fig. 113.—Scheme of the cardiac nerves in the rabbit (Landois and Stirling). P, pons; M, medulla oblongata; VAG, vagus; SL, superior, IL, inferior laryngeal; sc, superior cardiac or *depressor*; ic, inferior cardiac or cardio-inhibitory; H, heart.

METHODS OF INCREASING VAGUS-TONE.—Elsewhere (page 228), reference has been made to maneuvers for exciting the tone of the vagus and the practical ones may be recapitulated as follows: 1. Pressure at the 7th cervical spine by aid of the instrument shown in Fig. 112. 2. Position of the head, as shown in Fig. 65, and so maintained while observing the vagal phenomena. 3. Pressure in an intercostal space.

Preference is accorded to the first met[illegible] an assistant is present, although when one

intelligent patient, the second method suffices. Even without an assistant, one can demonstrate the exalted vagal reflexes, if pressure is made at the 7th cervical spine with the instrument, or in an intercostal space (firm pressure), with the finger, and one proceeds at once with percussion (some visceral reflexes do not exceed the duration of a minute). However, one may note in the following table the duration of the lung reflex of dilatation when pressure is made for one-half minute. Insomuch as the degree and duration of *descent of the lower lung-border* is most conveniently utilized in testing vagus-tone, a comparison of methods is cited in the normal subject:

COMPARISON OF METHODS.

METHOD	TIME IN APPLICATION OF METHOD	DEGREE OF DESCENT OF THE RIGHT LOWER LUNG-BORDER POSTERIORLY	DURATION OF DESCENT
Pressure corresponding to both sides of the 7th cervical spine..	One-half minute.	5 cm.	9 minutes
Forcible extension of the neck. (Fig. 65).	One-half minute.	4 cm.	3½ minutes
Pressure in an intercostal space.	One-half minute	3 cm.	1 minute
Direct concussion of the 7th cervical spine.	One-half minute.	4 cm.	2½ minutes
Sinusoidal current (rapid) with poles on either side of the 7th cervical spine.	One-half minute.	5.5 cm.	2½ minutes
High-frequency current on either side of 7th cervical spine with a double vacuum electrode (Fig. 100).	One-half minute.	5.5 cm.	2½ minutes

VAGAL-PHENOMENA.—During the time pressure is made at the 7th cervical spine with the instrument shown in Fig. 112, one notes the following:

1. Augmented tone of the heart, aorta, lungs, stomach, liver, spleen and intestines, manifested by increased dulness of the organs in question and better definition of their borders.*

Reference has already been made to visceral-tone (page 451), but to further appreciate the importance of this subject, let us refer to the *heart*. During diastole, the walls of the heart are relaxed but this diastolic relaxation varies with the tonicity of the heart-muscle. Fibers exist in the vagus of the frog, which, when stimulated, increase the tone of the myocardium. When one makes pressure as above, the cardiac muscle normally relaxed becomes rigid (diastolic rigidity). I employ this method for facilitating the *percussion of the heart* and in testing its *tone*. If the myocardium is normal, the precordial dulness is accentuated after the above maneuver, whereas, if diseased (diminished tone), the degree of dulness is unchanged. Forcible extension of the neck may likewise be utilized in testing the tone of the organs specified and determining their borders by regional percussion

2. Contraction of the pupils (this is not constant).
3. Closure of the crico-thyroid space.

The latter phenomenon is best elicited when the finger-tip is placed at the side of the crico-thyroid membrane. Pressure brings out the phenomenon best. If not detected easily have the assistant make intermittent pressure at the 7th cervical spine. The crico-thyroid muscle is supplied by the superior laryngeal (branch of the vagus) nerve, and it produces tension and elongation of the vocal cords. An hysterical paralysis of the vocal

*In association with the augmented visceral tone, there is *visceral contraction*, and this contraction is greater, *e. g.*, of the stomach at the 7th cervical spine than at the upper lumbar spines (page 316). Thus, the degree of stomach-contraction when the first three lumbar spines are concussed is only 2 cm., but 4 cm. after concussion of the 7th cervical spine. The same observation applies to the *spleen*.

cords may be diagnosed objectively by closure of the crico-thyroid space by the suggested maneuver.

4. Eosinophilia.
5. Hyperesthesia of the fauces.
6. Descent of the lower border of the lung (lung reflex of dilatation).
7. Diminution in volume of pulse and slowing to extinction.

It is more convenient to select the lower border of the lung posteriorly on either side. The lower border is first determined by percussion, after which pressure is made for one-half minute and the border again determined. In the norm the descent is about 4 cm. In vagus-hypertonia, it may descend 6 cm., and in hypotonia, it may descend only 2 cm., or not at all. Pressure between the spines of the third and fourth vertebrae causes the lower lung-border to recede. Increased vagus-tonus is generally associated with a low lung-border and its converse condition with a high border.

METHODS FOR DECREASING VAGUS-TONUS.—1. Pressure with the instrument (Fig. 112), at a point between the third and fourth dorsal spines.

2. Pressure behind both ears.

During the time such pressure is made one notes the following:

1. Diminished tone of the heart, aorta, lungs, stomach, liver, spleen and intestines.
2. Annihilation of the reflexes of the lungs, stomach, heart, aorta, spleen and intestines.
2. Pupillary dilatation.
3. Widening of the crico-thyroid space.
4. Anesthesia of the fauces.

5. Ascent of the lower lung-border (lung reflex of contraction.

6. Pulse diminished in volume and rapidity increased.

In this connection, it is necessary to note the approximation of the sites for increasing vagus-tone (7th cervical spine) and for diminishing it (between the 3d and 4th dorsal spines). A physician whose results were futile in the treatment of an aneurysm by concussion made the egregious error of employing a large concussor which embraced simultaneously the areas for increasing and diminishing vagus-tone.

2. PRESSURE BEHIND BOTH EARS.—The observations of Milligan and Horne have been confirmed by others: pressure applied to the mastoid processes generally relieves pain (due to faucial inflammation), in swallowing. Hald explains the effect as due to counter-irritation of the skin at a point where the sensory nerves are closely connected (centrally), with the sensory nerve-supply of the tonsils

In investigating this subject, the author finds that pressure between the 3d and 4th dorsal spine is the more efficient of the two methods. In both methods, *dysphagia* (whether due to faucitis or esophagismus), is combated by inhibition of the sensory functions of the vagus. Even in the norm, one may anesthetize the throat for practical purposes (laryngoscopic examination or introduction of a stomach-tube), by firm bilateral pressure for one or two minutes at the site noted (between the 3d and 4th dorsal spines). The anesthesia however, is limited in duration but it may be prolonged by resumption of pressure. In pressure behind both mastoids the same vagal phenomena ensue as were cited when pressure is made between the third and fourth dorsal spines. By bilateral mastoid-pressure one probably compresses the

auricular branch of the vagus which appears cutaneously behind the ear.

One must note another fact when vagus-tone is diminished by pressure between the 3d and 4th dorsal spines, *viz.*: dilatation of certain viscera. Thus, an aneurysm which shows a diameter of 4 cm., by percussion is reduced to 1 cm. when vagus-tone is increased by pressure at the 7th cervical spine and increased to 7 cm., when vagus-tone is decreased. Pressure or concussion of the region for reducing vagus-tone, produces greater dilatation of the aorta than the conventional site for eliciting the aortic reflex of dilatation (page 256). Thus, an aneurysm measures 4.8 cm. in the transverse diameter; concussion of the 9th-12th dorsal spines gives a measurement of 8 cm., and 10 cm., after concussion between the 3d and 4th dorsal spines.

THERAPEUTIC RESULTS.—Cures show the nature of diseases. Draper made the sapient observation that: "Mastery of all the sciences upon which medicine is founded does not make the physician . . . until he learns how to construct out of them the special art which enables him to cure disease." Broussais observed that the real physician is one who cures. A story is related of an American physician who was shown through a large pathologic laboratory in Paris, and was wearied looking at shelf after shelf loaded with pickled specimens of organs and tissues from people long since dead. At last he turned to the great pathologist and said: "Great God! where are the people you have cured?"

It is difficult to charm ache with air, and agony with words, and unless we call a halt on scientific medicine (?) we shall soon regard it as a misdemeanor should the patient be so presumptuous as to demand a cure.

A short time back, the author sent to a leading German

medical journal, a report of 40 cases of aortic aneurysm, symptomatically cured. Most men will agree that the cure of aneurysms should be considered one of the greatest contributions ever made to scientific medicine. The report, however, was refused publication, based on the assumption that, insomuch as aortic aneurysms were incurable, any reports to the contrary were in violation of our accepted theories concerning the pathology of the disease.

The physio-therapeutic methods suggested in this book for inhibiting or exciting visceral reflexes are equally available in diminishing or increasing vagus-tone. In the application of our method, whether it be concussion, pressure or electricity, we must always remember that to increase vagus-tone, we confine ourselves to the bilateral paravertebral area corresponding to the 7th cervical spine, and when vagus-tone is to be diminished, the site of election is between the 3d and 4th dorsal spines. Symptoms, in some affections, abate rapidly, whereas in others the results are more tardy. We may gauge our results by noting the degree of descent and position of the lower lung-border.

If the symptoms do not abate despite the augmentation or decrease of vagus-tone, then vagus-tone is in no wise related to the symptoms (page 451).

In the choice of the method to be employed, the physician can determine for himself the one most effective for causing either a descent (increased vagus-tone), or ascent (diminished vagus-tone), of the lower lung-border.

When ability is lacking in this regard, then concussion should be given the preference, insomuch as it is easy of application and generally reliable. Over-treatment must be avoided to prevent exhaustion of the reflexes.

The following table represents the degree of ascent of the lower lung-border after different methods to the

region between the third and fourth dorsal spines for decreasing vagus-tone:

CONCUSSION	2.3 cm.
RAPID SINUSOIDAL CURRENT	1.6 cm.
SLOW SINUSOIDAL CURRENT	1.6 cm.
PRESSURE	1.6 cm.
HIGH-FREQUENCY CURRENT	No ascent.

Fig. 114.—Base-knob for executing paravertebral pressure or eliciting paravertebral tenderness

The duration of retraction was greatest with the slow sinusoidal current; one pole applied on each side of the spine between the third and fourth dorsal vertebrae.

In many instances the patient is provided with two ordinary base-knobs (Fig. 114), and he is instructed to have some member of the family make firm pressure four times daily on either side of the spine (corresponding to the area to be influenced) for a period of time not exceeding one minute. To protect the skin and to locate the site of pressure the physician should apply a narrow strip of adhesive plaster.

One of my patients suggested screwing the base-knobs on the back of a chair or into a wall at a convenient

height and by bracing the feet, the patient can exert pressure himself.

In locating paravertebral tenderness, the physician will find the base-knob very convenient.

Another and most effective method which can be employed by the patient at home for *increasing vagus-tone*, is that of *extending the muscles of the neck*, as shown in Fig. 65.

Fig. 115.—Heart reflex elicited by the method of extending the muscles of the neck (*vide*, Fig. 65). The amplitude of the reflex is indicated by the reduced area of cardiac dullness extending from without to within the nipple.

This may be executed twice or thrice daily, and about twenty forcible extensions can be made at a séance.

In affections of the heart and other diseases caused by diminished tone of the vagus, my patients are instructed to execute these exercises in addition to treatment at my office. The effect of such exercise on a dilated heart is noted in Fig. 115.

Fig. 116 represents an apparatus for applying bilateral paravertebral pressure. Suspended from the middle bar is a suspension apparatus which is quite independent of the other.

Suspension Treatment, when first advocated for locomotor ataxia, was employed indiscriminately and soon passed into desuetude. With this treatment the patient

Fig. 116. Apparatus for applying bilateral paravertebral pressure. Adjusted to the bars are two pieces which can be raised or lowered. The front piece is provided with a cushion which is fixed to the chest with a screw and is used for counter-pressure. The back piece is provided with two small knobs (barely visible in the illustration), which are fixed over a definite vertebral area and by means of a screw any degree of pressure can be made. Suspended from above is a suspension apparatus which is independent of the other.

is suspended in a Sayre apparatus. This treatment is still used by the author as an invaluable method in some cases for the relief of pain, bladder-disturbances and impotency. The method is curative when pains simulating lumbago are really due to adhesions in the verte-

bral articulations. Suspension was used in 1829 by J. K. Mitchell, of Philadelphia, for affections of the cord secondary to vertebral disease. The investigations of Motschutkowski, show that during suspension, the nerve-roots pass from a horizontal to an almost perpendicular position and the cadaver was increased in length.

I have found that, during suspension, the *tone of the viscera is augmented.*

It is for the latter reason, if for no other, that suspension may be regarded as a valuable method of treatment.

Effects, almost equal to suspension may be achieved by having the patient sit on the floor or a table and then forcibly flexing the head and trunk upon the thighs, while the lower extremities are kept straight.

DISEASES CAUSED BY VAGUS-HYPERTONIA AND VAGUS-HYPOTONIA

DIABETES MELLITUS.—The great majority of cases of this affection observed by the author have been associated with *vagus-hypotonia*, and he has treated his cases by the method suggested on page 281. Since the results were published on page 283 he has encountered a group of cases yielding better results and even though no symptomatic cure was effected in several cases, the tolerance for carbohydrates was augmented. In two cases with a pronounced history of heredity (several members being similarly afflicted with diabetes), no results were achieved. The only restriction respecting diet was the avoidance of any excess of carbohydrates.

In several individuals with *alimentary glycosuria*, the assimilation limit for carbohydrates was increased by augmentation of vagus-tone by concussion. The test employed was that of Naunyn: two hours after a breakfast consisting of a roll and butter, with coffee, 100 grams of glucose, given

in solution, ought not to cause a glycosuria. If glycosuria ensues, the individual shows a diminished capacity for warehousing carbohydrates and true diabetes may eventually follow. The liver is the probable source of sugar production and is in turn controlled by the pancreas and suprarenals (the pancreas playing the *rôle* of inhibition, and the suprarenals that of stimulation in sugar production). The secretion of the thyroid inhibits the function of the pancreas as is demonstrated in the tendency to glycosuria in hyperthyroidism. After thyroidectomy, the inhibitory influence of the pancreas on the liver is so powerful that it is almost impossible to produce glycosuria. Modern writers regard the glycosuria ensuing from puncture of the medulla to be due to suprarenal stimulation, which excites the liver to an increased output of sugar. The puncture of the medulla stimulates the left sympathetic nerve and this stimulation is transmitted first to the left and then to the right suprarenal. If the left suprarenal is separated from the left sympathetic nerve, glycosuria does not follow puncture of the medulla.

If the vagus-tone is normal, adrenalin (given hypodermatically), will not cause glycosuria, nor will the ingestion of glucose up to 300 grams. Atropin diminishes or abolishes vagus-tone and in individuals with reduced vagus-tonus, even small doses may cause glycosuria.

One also knows that pilocarpin, which augments vagus-tone, will suppress glycosuria from adrenalin.

In several instances I have found glycosuria in susceptible individuals to follow paravertebral pressure between the 3d and 4th dorsal spines. This maneuver abolishes or diminishes vagus-tone (page 472).

In practically all of my diabetic patients I have found enlargement of the liver and the signs of diminished tone of the splanchnic circulation.

Dr. H. C. Sawyer reports[85] the following case of diabetes treated according to the method of the author:

"Female, fifty-two years of age, and weighing about 180 pounds presented herself April 9, 1910, with a history of incessant thirst and frequent urination owing to the excretion of enormous quantities of urine. The latter at this time had a specific gravity of 1,040 and contained eight per cent. of sugar; the reaction for diacetic acid was positive.

The following represented the average daily menu prior to the commencement of treatment which consisted of daily concussion of the seventh cervical spine of an average duration of about ten minutes: Breakfast.—Coffee, toast, and scrambled eggs. Luncheon.—Cold chicken, chop, asparagus, potatoes, and several slices of bread. Dinner.—Soup, egg salad, chicken, several slices of bread, asparagus, ice cream, and coffee. The foregoing diet was permitted during the treatment.

Within one week, polydipsia and polyuria had completely evanesced, but sugar continued in the urine varying in percentage from 5 to 0.77 per cent. on May 7, 1910.

After the latter date and up to the present time of writing (July 30, 1911.) there was absolutely no trace of sugar in the urine with the exception of one day when it reappeared temporarily after the patient partook, at a picnic, of a bottle of root-beer and ingested many other elements containing an excess of sugar.

Comments.—The reappearance of sugar on a single day was of no moment and indicated a physiological glycosuria which occurs in certain persons of apparently good health after the rapid ingestion of an excessive quantity of carbohydrates. From the evidence presented, the case in question can only be regarded as one of true diabetes mellitus. The rationale of the method consists of diminishing the quantity of blood flowing through the liver by augmenting the tone of the splanchnic blood-

vessels and thus improving the nutrition of the hepatic cells concerned in the warehousing of carbohydrates.

By the method of percussing the liver as suggested by Abrams, enlargement of the organ may be demonstrated in diabetes and a diminution of its volume may be noted after a single concussion séance. The latter fact is probably due to a diminished volume of blood in the liver and is not a true liver reflex such as is elicited by concussion of the spinous processes of the first three lumbar vertebrae.

Twenty séances of the concussion treatment in the foregoing case were necessary before the sugar disappeared from the urine."

It is the practice of the author, before commencing treatment to get the urine sugar-free and then to add, gradually, small quantities of carbohydrates to the dietary.

DISEASES OF THE THYROID GLAND.—Organotherapy has demonstrated the causal relation between this gland and a host of diseases. It has already been shown that the physiologic tonus of the vagus is probably dependent on the thyroid secretion. In diseases due to diminished thyroid secretion (*hypothyroidism*), vagus-tonus is increased and conversely diminished when the secretion is excessive (*hyperthyroidism*).

HYPOTHYROIDISM.—Insufficiency of the thyroid gland may be recognized by the tests on page 488, *et seq.* The diagnostic-therapeutic test by the administration of thyroid is equally valuable. Diseases caused by hypersecretion are aggravated, and those due to hyposecretion, are ameliorated or cured by thyroid.

One must give thyroid to obtain physiologic and not toxic effects (thyroidism). The symptoms of thyroidism indicate that the thyroid dosage must be reduced or interdicted. The signs of thyroidism are: anorexia, emaciation,

perspiration, insomnia, headache, nervous excitement, heart palpitation, tachycardia, tremors, prostration, etc. Insomuch as thyroid diminishes vagus-tone (page 459), it is not surprising to note that glycosuria may attend its administration. Thyroid function is identified with the metabolism of carbohydrates, insomuch as it has been shown that the administration of thyroid interferes with the retention or assimilation of carbohydrates. Thyroid should never be given in the presence of symptoms suggesting exophthalmic goitre.

The dessicated thyroid is a yellow powder made from the thyroid glands of sheep, and the dose varies from ½ grain to 15 grains. It is more convenient to give it in tablet form, and reliable tablets are made by Merck, Parke, Davis and Co., and Burroughs Wellcome & Co. It is also given as the raw, fresh gland of a sheep, on bread, beginning with the eighth part of a gland and gradually increasing the amount. The latter mode of administration is indicated when the dried preparations cause thyroidism. Thyroid has been given for every imaginable disease, but there are certain affections which empiricism has taught are identified with subsecretion of the gland.

In children *hyposecretion* and athyrea (absence of secretion), are associated with slow and stunted growth, retarded pulse, phlegmatic temperament, juvenile obesity, delayed puberty and cretinism.

In girls, delayed menstruation, amenorrhea, chlorosis, hysteria and epilepsy contribute to the symptomatology.

In the adult one finds myxedema and an abnormal tendency to obesity.

Many symptoms of senility have been attributed to hyposecretion, notably lesions of the skin (nutritive disturbances and eczema).

In certain forms of *melancholia* or hysteria, associated with depression and tardy cerebration, thyroid has been phenomenally efficient. Peabody,[86] avers that 75 per cent. of patients who die from mental disease show anomalous thyroid glands.

Vomiting of pregnancy is often arrested by thyroid administration, and many competent observers regard thyroid as an excellent treatment for *eclampsia.*

Epileptic attacks associated with the menstrual period have been cured by thyroid. Enlargement of the thyroid gland may be associated either with a diminished or excessive thyroid secretion. The enlargement may be structural (hyperplastic), or vascular. Vascular enlargement (peculiar to exophthalmic goitre), may be distinguished from hyperplasia (goitre), by the fact that a murmur or thrill is elicited when the gland is pressed upon.

HYPERTHYROIDISM.—In hyperthyrea, vagus-tone is diminished and this hypotonia is recognized by the tests on page 471, *et seq.*

Little can be expected of the diagnostic-therapeutic test for the reason that the various antithyroid preparations are inconstant in action and they are equally lauded by some and condemned by others.

Symptoms of hyperthyrea are accentuated by certain preparations described on page 453.

This disease occurs more frequently in women than in men.

Transitory hyperemia of the gland occurs in females at puberty, menstruation and pregnancy. It is not unlikely that many symptoms at these periods are caused by hyperthyroidism. The vascularity of the thyroid gland is enormous. Every minute, the quantity of blood passing through the gland is equivalent to six times its weight and it is said that it is twenty-eight times as vascular as the head, and five and one-half times as vascular as the kidney.

The symptomatology of exophthalmic goitre is made up of the classic tetrad: struma, tachycardia, tremor and exophthalmos.

The recognizability of such symptoms is facile. It is the recognition of minimal hyperthyroidism, which demands diagnostic acumen. Let us, however, first interpolate certain facts concerning the thyroid heart.

Cardiac disturbances may be associated with all forms of goitre and conduce to the condition known as ***thyroid heart*** (Kropfherz). Goitre, however, may be secondary to cardiac disease (cardiac goitre). The cardiac disturbances of a goitre may be due to essentially mechanic causes (pressure on the trachea, veins and sympathetic ganglia). When pressure is exerted on the sympathetic, tachycardia and exophthalmos (usually unilateral) ensue, leading to a clinical picture known as *pseudo-exophthalmic goitre.*

Cardiac disturbances may also be caused either by a deficient or excessive secretion of the thyroid gland. In the former (*cardiopathia thyreoprivea*), the dominant symptom is cardiac weakness, insomuch as vagus-tone is largely dependent on the secretion of the gland which is deficient. Early *arteriosclerosis* is another condition associated with hypothyroidism.

Insanity may be associated with a disfunctionating thyroid and psychoses concurrent with exophthalmic goitre are not infrequent. The psychotic symptoms represent one of two groups: maniacal agitation or a depressive type. Some authorities claim that chronic paranoia, dementia precox and even general paresis may be associated with exophthalmic goitre.

The fact must be emphasized that hyperthyroidism may be present without visible or palpable enlargement of the thyroid gland.

The active principle of the gland is *iodothyreoglobulin*. Thyreoglobulin is manufactured within the cells and acquires its iodin from the blood.

In hyperthyroidism, when an excess of iodothyreoglobulin is thrown into the blood, metabolism is augmented (loss of weight), and there is a stimulation of the peripheral nerves.

The early recognition of atypic forms of hyperthyroidism (*formes frustes*) is of great importance in determining the etiology of many obscure affections which masquerade under a medley of names. The symptoms peculiar to hyperthyroidism are accentuated by factors which augment the vascularity of the gland or decrease vagus-tone. Such factors are: menstruation, pregnancy, emotional disturbances (which diminish vagus-tone, page 466), sexual excitement, genital disturbances (chiefly uterine), infectious diseases (notably, influenza), coffee, tea, alcohol and certain drugs (iodids and especially, thyroid extract).

The fact that the thyroid gland is more active in women accounts for the predominance of their nervous and hysterical symptoms and the fact that exophthalmic goitre occurs more frequently in women than in men.

MENORRHAGIA in young girls and women is often a

symptom of hyperthyroidism, whereas hypothyroidism is associated with amenorrhea and chlorosis.

> *Menorrhagia* due to hyperthyroidism may be controlled by tablets of *mammary extract* in doses of about 4 grains taken thrice daily. The tablets must be crushed by the teeth before swallowing.

MENOPAUSE SYMPTOMS are unquestionably associated with hyperthyroidism. Among other early symptoms are,

1. *Cardiac signs;* palpitation and irregularity, increased pulse-rate, attacks of tachycardia and throbbing of the arteries. Digitalis has little or no action on the cardiac signs.

2. *Psychic signs:* mental excitement, restlessness and insomnia. The exalted states ensuing from wine or coffee are probably caused by a transient hyperthyroidism.

3. *Ocular signs:* widening of the palpebral slit, staring without winking for a considerable time and inability of the lids to follow the eyeballs when vision is directed at the descending finger of the physician. In the author's experience when the lid does follow the finger, it drops ***in toto*** and not gradually.

The author has noted an accentuation of the latter symptom (v. Graefe's sign) when the finger of the physician is directed downward in an *oblique direction.* He has further noted a slight spasmodic retraction of the lids when vision is directed downward in an oblique direction. When the patient first looks at an object, there is usually a spasmodic contraction of the upper-lid (Kocher-Boston sign).

4. *Nutritional sign:* Loss in weight despite good appetite and digestion.

Among other early signs are: Feeling of heat, elevation of temperature, flushes, perspiration and a fine tremor.

> The *tremor* is best observed when the patient is directed to spread the fingers. In hyperthyroidism, not-

ably in exophthalmic goitre, I have noted a tendency of the fingers to become adducted when separated and this tendency especially implicates the middle and fourth finger.

There is another symptom which I have observed and that is *dyspnœa on exertion*. This symptom may be caused by a *dilated aorta*, a condition which is frequently associated with exophthalmic goitre and which is easily recognized by careful percussion (page 55). Kocher directs attention to tenderness of the thyroid, a systolic blowing over the thyroid arteries, and a characteristic blood picture: leucocytes half as numerous as usual, neutrophiles reduced and lymphocytes twice the normal figure. In the absence of this constant blood-picture, he will not operate.

The symptoms of hypersecretion and hyposecretion of the thyroid may be recapitulated as follows:

SYMPTOMS OF HYPERTHYROIDISM AND HYPOTHYROIDISM[57].

HYPERTHYROIDISM.	HYPOTHYROIDISM.
1. History of fatigue and slow onset.	1. The same.
2. More common in adolescence than in middle life and in women.	2. More common during and after middle life and in women.
3. Cutaneous flushing; tachycardia; manifest overaction of heart; pulsation of cervical vessels; all increased by exertion; blood pressure 120-130.	3. Flushed skin over malar prominences only, marked pallor elsewhere; slow pulse; blood-pressure usually below 120.
4. Mental instability and excitability rather than mental alertness; tremor; restlessness; quick, jerky movements of extremities; insomnia.	4. Mentality sluggish, rather than dull; headache; insomnia with changes to somnolence only in terminal stages; slow movements.

5. Muscular weakness and inability to withstand ordinary fatigue.	5. The same.
6. Exophthalmos generally present in some degree, and the more marked it is the worse is the prognosis. It is often absent in the early stages.	6. No exophthalmos except in those who have passed through a preceding Graves' disease. In place of it there is a characteristic puffiness and edema around the eyelids and in the supraclavicular regions and on the back of neck and below the knees.
7. Goiter of variable size and consistency. Its vascularity and density give some indication of the relative importance of the thyroid in the general disturbance; goiter is often imperceptible in the early stages.	7. Goiter is common, but by its consistency and absence of vascularity suggests a functionless organ.
8. Appetite abnormally good and out of proportion to the evident poor nutrition; movements regular or diarrheic. Thirst constant.	8. Appetite poor; apparently good nutrition. Constipation. No thirst.
9. Skin moist with a subjective feeling of heat.	9. Skin dry and scaly; subjective feeling of cold.
10. Temperature 99 to 101.	10. Temperature subnormal.
11. Blood shows relative lymphocytosis, anemia slight or absent.	11. Negative, anemia regularly.
12. Menstruation irregular or absent.	12. Regular but scanty, occasionally excessive.
13. Urine in nitrogen partition shows excess of creatin and diminished creatinin.	13. Negative; albumin sometimes present.

The TREATMENT of exophthalmic goitre is equally applicable for the minor and atypic manifestations of hyperthyroidism.

In the conventional medical treatment, which ranges from Galvanization of the cervical sympathetic and exposure to the X-rays to the use of specific sera, the results are uncertain and recurrence is the rule.

Respecting operative treatment (thyroidectomy), the results achieved by Kocher (who has had the largest experience in such cases), are as follows: absolute and permanent cure in 83 per cent., and 3.5 per cent. of deaths. C. H. Mayo had 9 deaths in 176 cases.

Removal of the sympathetic ganglia (sympathectomy), on both sides is a procedure unattended by good results.

The author's method of treatment (page 280) is practically a *specific* in hyperthyroidism and the results are immediate and usually permanent. Recurrence of symptoms is transient and associated with factors which augment the vascularity of the thyroid gland. The first symptoms to yield are tachycardia and cardiac irregularities, nervousness and perspiration. Exophthalmos is the most resistant sign and may yield synchronously with the other signs, it may improve after treatment is suspended or it may be permanent.

Operations yield no better results, for in cases of long standing the exophthalmos is permanent owing to the deposit of orbital fat which causes the eye to protrude even though the muscle of Müller is no longer contracted.

The *exophthalmos* and separation of the lids in Exophthalmic goitre is caused by contraction of Müller's muscle which is innervated by the cervical sympathetic. This muscle is attached to the bony wall of the orbit and is inserted into the sclerotic coat of the eyeball and the upper or lower lids.

Exophthalmic Goitre

Reports received from many physicians, respecting the author's treatment of exophthalmic goitre are very encouraging. In several instances, only the methods of concussion shown in Figs. 2 and 3 were used.

One physician writes, "in one week tachycardia reduced from 160 to 110, enlargement of thyroid gland decreased about one-half, although exophthalmos is the same."

Another reports, "I have never witnessed such rapid and marvelous results in the treatment of a disease."

Another says, "Within three weeks practically every symptom disappeared but at the next menstrual period some symptoms recurred but have not reappeared up to the present time of writing."

A physician, whose enthusiasm regarding the author's method was dictated by results, observes as follows: "It is only a question of time when physicians will and must recognize your specific treatment and when it will be regarded as criminal negligence for the physician to invoke surgery before giving your method a trial."

A physician reported, "The symptoms were aggravated." On inquiry, I found that he was concussing not only the 7th cervical spine, but likewise the upper dorsal spines (which decreased vagus-tone). I have never heard further concerning his results. Any of the methods for increasing vagus-tone as suggested on page 469, are available in treatment.

Dr. M. Turnbull cites one case with a history of exophthalmic goitre for 15 years. Despite an operation (ligation of thyroid arteries), the enlarged gland and cardiac signs persisted. Within 2 weeks, no gland could be seen nor palpated and the cardiac signs, tremor, etc, disappeared. At one menstrual period, the gland enlarged for 2 days.

In this patient, a woman of 28, the hair had become thin and absolutely white. Soon after the commencement of treatment, the hair grew more luxuriantly and is being restored to its natural color (brown).

In another patient, all the symptoms subsided in three weeks excepting the exophthalmos which was ameliorated about 50 per cent. The patient gained one-half pound a day for about three weeks. In both cases, the treatment was concussion of the 7th cervical spine.

In some of the author's cases, patients who were apparently obese lost considerably in weight. This was probably due to edema and myxedema complicating exophthalmic goitrc and coincident with improvement of the latter, myxedema and edema disappeared.

Among letters received from physicians, one question is paramount: "Will concussion cure simple forms of goitre?" The reply to this question may be as follows: The greater the vascularity of the gland (soft and tender, systolic blowing), the greater is the chance for its reduction. When much fibrous tissue has developed no results can be expected.

Treatment by concussion is so simple that it should at least be given a trial.

Very often a goitre is a true hypertrophy occurring in response for an augmented supply of secretion. Here, the use of thyroid extract will cause a reduction in the size of the gland.

EMACIATION.—In some individuals despite careful examination, one cannot account for their poor nutrition. Weir Mitchell, and later, Playfair, demonstrated the great value of forced alimentation in many neuroses. This mastcure or methodical overfeeding was used in combination with an absolute rest cure. As I take a retrospect of the cases thus treated and of my success and failures, I now believe that I was unconsciously treating thyroid glands in a condition of hypersecretion. In a rest cure one executes all the methods necessary to depress the functions of the gland, viz.: rest, seclusion, quiet, an absence of genital irritation and sexual

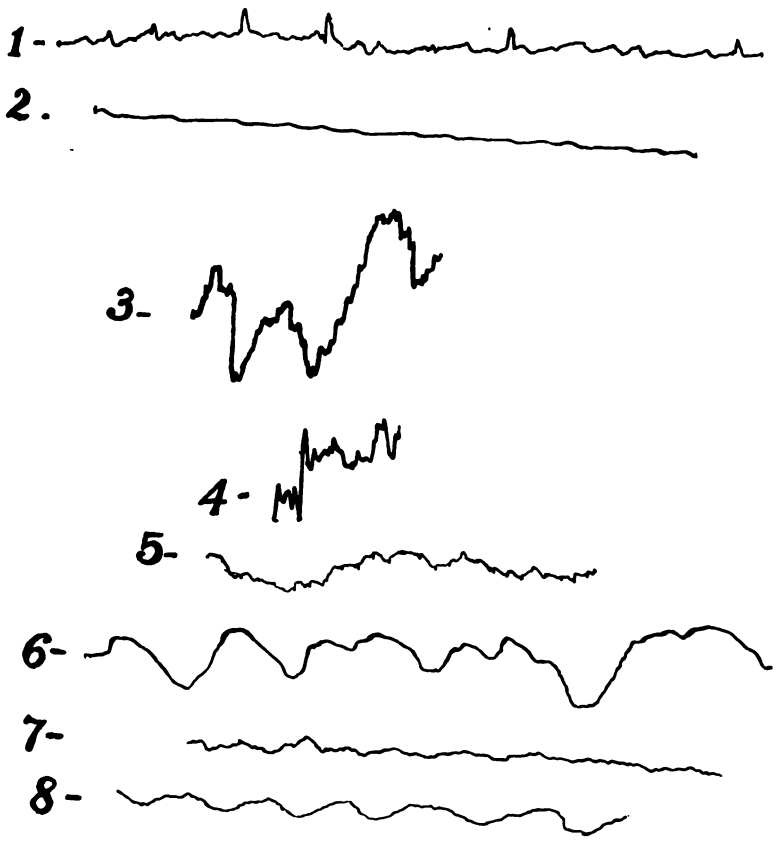


Fig. 117.—Case of Exophthalmic goitre made up of the following tetrad: tachycardia, exophthalmos, tremor and pulsating thyroid gland. 1.—Sphygmogram of pulsating struma before commencing treatment (the record shows tachycardia and irregularity of pulsations); 2.—Tracing of gland after 5 minutes application of the rapid sinusoidal current in the region of the 7th cervical spine. 3.—Tracing of tremor before treatment; 4.—Tracing of tremor after sinusoidalization in the region of the 7th cervical spine; 5 and 6.—Cardiogram and pneumogram before, and 7 and 8, the same after concussion of the 7th cervical spine. Respiratory ataxia (page 85) is a not infrequent sign (according to the observations of the author) in this disease. This patient's heart became absolutely normal in rhythm after 3 treatments of concussion to the seventh cervical spine although this irregularity had existed since the inception of her disease 15 years before.

excitement and a diet of milk and farinaceous foods with a minimum of meat.

Many of my cases in women suffered from relapses and not infrequently three rest cures were given in a single year. Some of these cases showing reduced vagus-tonus, have since then been treated successfully by concussion of the 7th cervical spine or by paravertebral pressure. Improvement is associated with an increase in weight without any change in the diet. Treatment at my office was supplemented by contraction of the cervical muscles (page 228) or by paravertebral pressure corresponding to the 7th cervical spine (page 467), three or four times a day for one minute each time.

Bronchial Asthma.—Reference has already been made to this subject on page 303, with supplementary observations on page 456. This disease is practically always associated with vagus-hypertonia. Even in the norm, if an assistant maintains firm pressure at the 7th cervical spine with the instrument shown in Fig. 112, within thirty seconds to two minutes, one can auscultate *râles* peculiar to asthma In asthmatics or in cases of vagus-hypertonia, less pressure or a shorter interval of time is necessary to create *râles*.

Asthmatic paroxysms may be arrested by firm pressure with the thumbs in the absence of an instrument on both sides of the column between the third and fourth dorsal spines.

The foregoing facts are of great importance in *pulmonary auscultation*. Many adventitious sounds are due either to increased or diminished vagus-tonus and by availing ourselves of the maneuvers suggested, one may avoid errors in diagnosis.

Boeri[88], found that when no abnormal breath-sounds were heard over the apex in incipient phthisis, they became audible after a few minutes deep massage over the apex of

the lung. The phenomenon in question is probably due to an augmentation of tone of the vagus ensuing from massage. Stretching the neck (Fig. 65) several times in succession accomplishes the same object.

Phthisis is a disease usually due to hypertonia, and one frequently finds it associated with bronchospasm, a condition not unlike asthma. If one makes pressure for about one minute between the third and fourth dorsal spines, the *râles* peculiar to asthma or bronchospasm disappear.

Respecting the treatment of asthma, my experience concerns itself chiefly with the method described on page 312. My more recent experience justifies me in saying that I believe more expeditious results *may be* achieved by depressing vagus-tone and to attain this object it is suggested to employ sinusoidalization or concussion of the region for depressing the vagus and to supplement it by treatment at home, *viz.*: pressure three or four times a day for one minute at a point on either side of the column between the third and fourth dorsal spines.

In my experience, paroxysmal dilatation of the thoracic aorta may simulate asthma. Here one finds by careful percussion an increase in the area of aortic dulness. Vagus-tone is diminished and not increased as in asthma. In such instances of *pseudo-asthma*, the treatment indicated is that for aneurysms.

EMPHYSEMA.—Increased vagus-tonus is associated with this condition in a number of instances, notably in young persons. We have already noted (page 296) how one may transitorily dissipate the disease by nasal cocainization. The methods employed for reducing vagus-tone should be given a trial. One must, however, carefully supervise the treatment to avoid the development of symptoms dependent on reduced vagus-tonus.

In some instances, diminished vagus-tone being present, the antithetic method of treatment is indicated.

CARDIAC NEUROSES.—The pharmacologic diagnosis of these affections has been discussed on page 454. They may be associated with increased or diminished vagus-tonus.

GASTRIC NEUROSES.—The vagus controls the tone, peristalsis and secretion of the stomach. When the tone of the nerve is pathologically increased the motor, sensory and secretory phenomena of the organ are accentuated and give expression to clinical pictures identified with the gastric neuroses.

Esophagismus, may be attributed to the same cause and one may note its temporary evanescence by methods which reduce vagus-tone, *viz.*: paravertebral pressure or an hypodermatic injection of atropin.

INTESTINAL NEUROSES.—In the diagnosis of these affections one must remember that atropin inhibits and that pilocarpin, intensifies intestinal peristalsis. The many affections identified with increased or diminished vagus-tone include diarrhea, constipation and *membranous enteritis*. The latter is probably a motor-secretory neurosis and is favorably influenced by atropin. In individuals with this disease, the use of pilocarpin may precipitate a paroxysm.

DISTURBANCES OF VISION.*—Vagus-tone is identified with hysterical and neurasthenic forms of *amblyopia* and *asthenopia*.

The former refers to reduced visual acuity, contraction of the field of vision and the field for colors.

The diagnosis of hysterical amblyopia is established by the absence of demonstrable ocular changes, exhaustion of the visual field during examination and by the fact that the

*A preliminary reading of the subject-matter on page 441, will aid in the better understanding of this caption.

contraction of the field for colors is reversed (limits for red wider than those for blue.)

The oculist observes that the acuity of vision and the extent of the visual field varies with the amelioration or aggravation of the health of the patient.

That this form of amblyopia is a matter of vagus-tone I have demonstrated as follows: In a normal subject, determine with a perimeter the extent of the normal field of vision and the field for colors. Then, during the time the vagus-tone is depressed by an assistant (pressure between the third and fourth dorsal spines), again determine the fields. One notes that the visual field is contracted and the field for colors reversed. Pressure at the 7th cervical spine will increase the extent of both fields.

In *asthenopia*, despite good visual power, the eye becomes incapacitated for continuous exertion and the patient complains of pains in or above the eyes, frontal or occipital headaches, neuralgia, lacrymation and burning sensation in the lids, blurring of near vision and a host of other symptoms.

The foregoing signs are always accentuated with artificial illumination, after reading, writing, sewing and other forms of near application and in disturbances of the general health. Even in the norm, one may provoke asthenopic symptoms by reducing vagus-tone (pressure between the third and fourth dorsal spines), during the time patient is requested to read. Each eye may be separately tested. Pressure at the seventh cervical spine will improve acuity of vision and in asthenopia, vision previously blurred, becomes sharp and defined.

The maneuvers suggested do not modify the vision of an astigmatic, myopic or hypermetropic eye.

We have already demonstrated (page 443), that eye-strain is equivalent to vagus-stimulation and will evoke the vagal-

reflexes. If, however, one cocainizes the eyes with a 5 per cent. solution in a normal subject, the vagal reflexes cannot be obtained. Paradoxical as it may appear, the reflexes continue despite the use of homatropin or atropin.

The foregoing facts are in defiance of current opinion insomuch as atropin as a cycloplegic, by paralyzing accommodation, is supposed to annihilate the majority of ocular reflexes. I have, however, made repeated tests in this respect and the results have been practically uniform.

The preceding facts furnish an important guide in treatment. Many patients with amblyopia and asthenopia suffer for years and are incapacitated for serious occupation. Glasses often give no relief and stimulation by strychnin and electricity are the usual remedies.

Concussion or sinusoidalization of the seventh cervical spine to increase vagus-tone, and supplementing this method by home-treatment (paravertebral pressure or extension of the muscles of the neck), may rescue some patients from hopeless invalidism.

In rarer instances, *spasm of accommodation* (asthenopic symptoms and diminished acuteness of vision), may necessitate depression of vagus-tone (pressure between the third and fourth dorsal vertebrae or concussion of the latter).

> Dr. B. L. Baker, of Seattle, referring to a patient with intractable symptoms in whom sinusoidalization (electrodes on either side of the 7th cervical spine) was employed, observes as follows: "Abnormal sensations of long standing were removed and she was able to be fitted with glasses in a very satisfactory way. Perfectly so in her left eye which we were never able to do. The eyes when turned in any direction caused intense pain and nausea but the latter symptoms have disappeared."

DISTURBANCES OF HEARING.—I believe that the sense of

audition is under the control of the autonomic nervous system.

The following simple experiment will show how audition may be improved or diminished; determine with a normal subject the distance at which the tick of a watch is heard in the ear under examination. If an assistant now presses the seventh cervical spine with an instrument (Fig. 112) to increase vagus-tone, the patient perceives the tick at a greater distance. If pressure is now made between the third and fourth dorsal spines, to diminish vagus-tone, the tick is heard with less intensity and at a diminished distance. Hearing in the norm may be made more acute after concussion of the seventh cervical spine or after exercises which embrace extension of the head (page 228). More accurate quantitative tests may be made with Politzer's acoumeter.

The auditory nerve consists of the cochlear and vestibular roots. The former is concerned in hearing and the latter in the maintenance of equilibrium. *Hyperesthesia* and irritation of the nerve may be manifested by hyperacusis (sounds heard with disagreeable intensity), dysacusis (sounds cause unpleasant sensations), or as *tinnitus aurium* (subjective sounds). Another symptom of irritation may be dizziness somewhat like Menière's disease. Diminished function or *nervous deafness* is not infrequent in hysteria and bone conduction is impaired or lost.

Neurasthenia and hysteria are the most frequent functional nervous affections which exert the most pronounced effect upon the organ of hearing. With the tests cited, one may facilitate diagnosis. The specialist does not hope to modify these functional symptoms without treating the conditions which cause them. However, one must not forget that they may be signs of a local vagus-hypotonia or hypertonia, (page 452), and may be modified or cured by treating the irritative (reducing

vagus-tone) or paralytic symptoms (increasing vagus-tone).

The *sense of smell* may also be modified according to the methods cited for increasing or decreasing the sense of hearing.

One may continue to dangerous extremes in the discussion of this subject. The author has limited himself to a consideration of questions which he has amply verified by clinical results and he has attempted to show the necessity for testing vagus-tone as a routine measure in clinical practice with the hope that it may lead to a betterment of our nosology. In *diagnosis*, diminished or increased vagus-tone may modify symptoms, and I shall show how one may create at will certain cardiac murmurs and how they may be made to disappear (page 525). The creation of adventitious respiratory sounds has been already discussed (page 494).

Phylogenetic Diseases.

The term phylogenesis, refers to the evolution of a group or species of animals or plants from the simplest form. For a like reason, I employ this designation in accordance with my concept that many diseases and symptoms owe their origin to a primal basic anomaly. The preceding contravenes the ontogenic conception of disease.

Among the diseases in which I have established *reduced vagus-tone* are the following:

1. Aortic dilatation.
2. Aneurysm.
3. Diabetes.
4. Hyperthyroidism.
5. Pertussis.

A dilated aorta is probably one of the causes of dyspnea in exophthalmic goitre (page 488). In four of my cases,

classic symptoms of aneurysm (thoracic) were associated with Basedow's disease.

Glycosuria was found in several patients with aneurysm.

> A patient with an aneurysm of the thoracic aorta, referred to me by Dr. Hubert N. Rowell, of Berkeley and who was discharged as symptomatically cured after treatment lasting four weeks, returned after three years absolutely well respecting the aneurysm but with symtoms of diabetes (3 per cent. of sugar despite the most rigid diet). Vagus-tone absent. Within three weeks after treatment (concussion of seventh cervical spine), the lower lung-border which did not descend at all when pressure was made at the 7th cervical spine-region, descended 3 cm., and sugar disappeared from the urine, notwithstanding the ingestion of the average carbohydrate consumption. At the time of writing, the patient is well. Before coming to my office the second time, the attention of the patient was called to his condition by polyuria and an intractable neuritis. The latter disappeared with disappearance of sugar in the urine.
>
> It is easy to explain many anomalies of function by correctly assuming modifications in glandular activity. Thus, the amount of ***epinephrin*** produced and entering the circulation varies. This substance stimulates plain muscle and glandular cells which are functionally related to the sympathetic nerve-fibers. Its subcutaneous administration causes the appearance of dextrose in the urine and a condition of hyperglycemia.

Exophthalmic goitre is coordinated with emaciation and occasionally, with polyuria, glycosuria and true diabetes.

Pertussis is associated with aortic dilatation (Chapter XVII) and in both affections the vagus-tonus is reduced. Some infectious diseases reduce vagus-tone and they may be recognized as etiologic factors in Basedow's disease and aneurysm (syphilis).

A neurotic temperament (reduced vagus-tone) is a dominant etiologic factor in diabetes. One notes the occurrence of the same or like diseases in one family or between man and wife, maladies which I have called *diseases of propinquity*. Contagious influences like tuberculosis are not included in this category. Thus, Schmidt observed among 2320 diabetics, twenty-six cases in which the disease occurred concurrently in man and wife.

It is questionable concerning the *rôle* played by food in the etiology of reduced vagus-tone, although my limited observations show that an exclusive diet of proteid food has a marked influence in reducing vagus-tone.

I recently saw two sisters in consultation with Dr. L. Boyd, of Long Beach, one of whom had diabetes, and the other an aneurysm of the thoracic aorta.

Among the diseases in which there is increased vagus-tone are:

1. Bronchial asthma.
2. Emphysema.
3. Tuberculosis.
4. Gastric and Intestinal Neuroses.

Emphysema is almost invariably associated with phthisis and asthma. In my clientele, I have frequently noted pulmonary tuberculosis following asthma and observed that the cough and paroxysmal dyspnea of the latter affection were often caused by *bronchospasm*. Asthma often runs in families with irritable nervous systems and the reflex causes which provoke attacks also augment vagus-tonus.

Many gastric and intestinal neuroses are associated with symptoms of cardiac disease suggestive of vagus-hypertonia.

Enuresis, was frequently observed by the author in asthmatic children and reduction in the tone of the vagus

was productive of good results. The mother was instructed to make pressure several times a day on either side of the spine between the 3d and 4th dorsal vertebrae to reduce vagus-tone.

Dr. L. Boyd reports the case of a young man of 20 years, with enuresis since birth. Treatment had been tried without results. Concussion of the fifth lumbar vertebra to provoke the *bladder reflex* (page 358) yielded excellent results.

A *placebo* was given to the patient. The author finds it absolutely necessary with some patients to employ an indifferent drug in association with treatment. Some patients are obsessed with the conviction that drugs are the *fons et origo* of medical practice and they will continue no treatment in which drugs are excluded.

"It is quite as important to know what kind of a patient the disease has got, as to know what kind of a disease the patient has got."

"The patient wishes not only to be cured, but to be treated; his luxury is the importance of the physician and his remedies."

Reflex symptoms may so mask the primary disease that the latter is disregarded. Reduced tone of the vagus is associated with dilatation of the heart and the symptoms may be essentially abdominal owing to the rapid distension of the liver and the paralytic inflation of the stomach and intestines.

The attacks in some forms of angina pectoris and certain neuroses terminate with eructations of gas and the discharge of a large quantity of clear urine.

What probably occurs is as follows: The increased vagus-tonus closes the cardiac or pyloric orifice of the stomach and when the tone of the vagus is reduced, the orificial spasm of the stomach yields, permiting eructation of the incarcerated gas.

I have seen two cases of aneurysm of the abdominal aorta in which there were only thoracic symptoms.

The crises of *tabes* are caused by autonomic irritation as evidenced by pupillary contraction, increased secretion and peristalsis of the stomach and intestines. In the later stages of the disease, the hypertonic are succeeded by hypotonic signs. One knows that in *tabes*, anatomic lesions of the vagus may be demonstrated.

VAGAL HYPERESTHESIA.—In diseases caused by vagus-hypertonia, the vagus in the neck is extremely sensative to pressure, whereas in diseases caused by vagus-hypotonia, paravertebral areas of tenderness may be detected between the third and fourth dorsal spines.

The sensitiveness in question disappears *pari passu* with the disappearance of the disease. The dorsal areas become less sensitive at once by concussion of the 7th cervical spine (which increases vagus-tone) and the vagus in the neck, by concussion of the third and fourth dorsal spines (which decreases vagus-tone).

CLINICAL PHARMACOLOGY.

The scientific study of pharmacology should not be limited to laboratory-animals, on the contrary, the human offers a fruitful field for investigation (*vide*, page 270). The author has investigated many drugs and concludes that a large number owe their physiologic and toxic action to their influence on vagus-tone. Only a few drugs will be cited, insomuch as the scope of this work precludes any extended reference to this subject. The author suggests, however, that it may serve as an index for research work along new and original lines.

Many drugs, according to their action, may be divided into two classes:

1. Drugs which increase vagus-tone;
2. Drugs which diminish vagus-tone.

Their action may be manifested directly or indirectly. Thus adrenalin acting exclusively on the sympathetic-fibers by stimulation, depresses the vagus-fibers and therefore indirectly diminishes vagus-tone (page 453).

METHOD OF INVESTIGATION.—As we have already shown (page 469), paravertebral pressure at the 7th cervical spine increases vagus-tone and among other effects it causes the lower-lung border to descend. The degree and duration of descent are accepted as criteria of vagus-tone. The lower lung-border posteriorly is first determined, after which pressure is made opposite the 7th cervical spine for 30 seconds and the lower border is again ascertained. Not only must we determine the degree of descent but its duration.

Drugs which act by increasing vagus-tone cause a descent of from 4 to 6 cm., and this descent is maintained from one to ten or more minutes. Drugs which diminish vagus-tone cause little or no descent of the lung and if the latter does descend, its descent is brief. Many drugs show a primary stimulation of vagus-tone followed by depression of the latter. Powerful vago-tonic drugs cause a descent of the lung-border without previous pressure at the 7th cervical spine.

Reference has been made to some drugs investigated by the author. Among other drugs may be mentioned:

QUININ.—This drug has a powerful action in increasing the tone of the vagus.

It is now possible to comprehend many therapeutic facts heretofore inexplicable.

Exophthalmic goitre is due to diminished vagus-tone (page 484). Now, among the most satisfactory drugs for influencing the latter disease is ***quinin hydrobromid*** in capsules containing 5 grains each, to the limit of the patient's tolerance. Toxicity is shown by the appearance of tinnitus, when the use of the drug must be suspended

temporarily. The drug must be taken for months or years. In a study of 56 cases thus treated by Jackson[89], 76 per cent. had no signs or symptoms for two years, while 13 per cent. had been benefited, and only 6 cases (11 per cent.) could be considered failures. Within two weeks after taking this drug, improvement was noted by diminution of the palpitation, sweating, tremor and other nervous symptoms. In many cases the thyroid diminished in size, but the exophthalmos was the last sign to disappear (2 or 3 years) or it persisted with the tremor.

MALARIA.—A typic paroxysm of this disease may be precipitated by eliciting the splenic reflex of contraction (page 355). I saw a case of latent malaria with Dr. R. Bine, in which a typic paroxysm was precipitated on the day following the elicitation of the reflex.

We speak of quinin as the most effective parasiticide in this disease and there is ample reason to justify such a conclusion but in this action, we dare not ignore the bactericidal power of the blood owing to the protective substances or by anaphylaxis. Italian observers claim that the present drug-treatment of malaria is unable to free the system completely of the malarial parasites. As long as the spleen is enlarged the disease cannot be regarded as cured. A single hypodermatic injection of 15 grains of quinin and urea hydrochlorid will, in malaria, cause a "freedom period" lasting either 6½ or 13 days (S. Solis Cohen). A small dose (0.3 to 1 gram, at intervals of 3 days to one week—about half a dozen injections), will often enable one to demonstrate plasmodia in the peripheral blood although previously absent (Billings).

Now, the action of quinin is to increase vagus-tone and, by so doing, to contract the spleen. *Strychnin*, is likewise a vagus-tonic and within one hour after an hypodermatic injection of a therapeutic dose, the plasmodia of malaria may be demonstrated in the peripheral blood although previously absent.

Quinin is effective in enlargement of the spleen from any cause simply because it contracts the organ by stimulation of the vagus.

Perhaps the time will yet arrive when we shall gauge the value of drugs in malaria according to their action on the vagus and that pilocarpin or other efficient vagal excitant may be used to the exclusion of quinin.

In a case of splenic leucocythemia, I could always produce an enormous increase of leucocytes in the blood immediately after the elicitation of the splenic reflex of contraction.

Leucocytosis, following the hypodermic injection of pilocarpin, is essentially mechanic and due as Henwood, of Toronto, suggests to contraction of the muscle-element in the spleen and lymph-glands.

DIABETES.—Magyary-Kossa[90] extols the inhalation of *carbon dioxid* to reduce glycosuria. In diabetes, diminished vagus-tone can be demonstrated (page 479), and carbon dioxid is a vagal-excitant.

Suspension of respiration for 30 seconds or longer increases vagus-tone.

Our present conception of *shock* is not attributed to vasomotor failure, but to *acapnia* (diminished carbon dioxid in the blood). Stimulation of the respiratory center depends upon carbon dioxid alone, oxygen playing a passive part.

No one drug in diabetes seems to have a curative influence.

Arsenic may act by increasing vagus-tone, and opium, bromids and antipyrin probably achieve their action by subduing the neurotic element in this disease.

Antipyrin primarily excites the vagus for about 5 minutes and is then followed by powerful depression of the nerve.

The *iodids*, *chloroform* and ether, diminish vagus-tone. The latter act as evanescent vagal-irritants, but there is a marked secondary depression of tone.

Potassium iodid often acts as a specific in asthma

and this is probably attained by diminishing vagus-tone, which in asthma is increased. *Fowler's solution* often prevents iodism, iodin diminishes and arsenic increases vagus-tone.

Potassium iodid is used empirically in aneurysms. The effects are probably attained by diminishing blood-pressure, for by diminishing vagus-tone, the aneurysm dilates. It may be that the latter is less than the reduction in pressure, otherwise the drug would do more harm than good.

Nasal cocainization elicits an immediate depression of vagus-tone, whereas the inhalation of *ammonia*, increases the tone.

Amyl nitrite inhalation increases vagus-tone. This drug, in my experience, is only efficient in the cardiectatic forms of *angina pectoris* due to diminished vagus-tone (page 543).

Sodium cacodylate and *mercury* are powerful tonics of the vagus. The latter observations invite theorization, which will however be curtailed. The present treatment of syphilis with *salvarsan* is chemo-therapeutic, and by the method of "*therapia sterilisans magna*," the action of the drug is parasitotropic.

In syphilis, I have found diminished tone of the vagus and it is not improbable that remedies in this disease (excepting the iodid), by increasing the tone of the vagus accomplish another object as yet not definitely known.

Reliable preparations of *digitalis* and *strophanthin* given hypodermatically increase the tone of the vagus. Within 15 minutes, the lung-border may be made to descend double the distance that it did prior to the injection. After this manner, the author tests the reliability of these drugs which are notoriously unreliable. A normal subject is used for experimental purposes. In the same way, one can predict the action of the drugs on patients.

Recapitulation.

The vagal and sympathetic fibers in the norm are in physiologic antagonism. The ideal vagal-stimulant is pilocarpin, and the ideal sympathetic-stimulant is adrenalin. Atropin diminishes vagus-tone by paralyzing the motor endings of the vagus. Thyroid diminishes vagus-tone.

Symptoms or diseases (asthma, angina pectoris), due to increased vagus-tone are acentuated by pilocarpin and ameliorated by adrenalin and atropin.

The toxic action of some drugs may be inhibited by combining them with their physiologic antagonists. Thus quinin may be used with thyroid or pilocarpin with the iodids. However, this method is not scientific, for we are administering synchronously a drug with its antidote, an undesirable procedure when one desires to test adequately the physiologic action of a medicament.

Therapeutically, we employ drugs which increase vagus-tone (pilocarpin) in diseases which demand them and conversely, drugs which decrease vagus-tone (thyroid, iodids, adrenalin) are indicated.

CHAPTER XIV.

FURTHER ADVANCES IN THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE CIRCULATORY SYSTEM.

TESTS FOR HEART—SUFFICIENCY—KUATSU—HEART-FAILURE—FUNCTIONAL CARDIAC MURMURS—REFLEX OF THE PULMONARY ARTERY—INHIBITION OF THE HEART—CARDIOPTOSIS—SUBCLAVIAN MURMURS—ANGINA PECTORIS—ANGINOID PAINS—PHRENIC NERVE—DIAPHRAGM REFLEX—ANEURYSM—FLUOROSCOPY OF THE AORTA.

TESTS FOR HEART-SUFFICIENCY.*

In making a comparative estimate of different functional tests of cardiac efficiency, the author is constrained to conclude that the test to be specified presently is the most reliable.

Numerous writers confirm the observation of de la Camp, viz., when the cardiac muscle is normal, exercise even carried to exhaustion and fainting does not produce dilatation of the ventricles. On the contrary, the heart diminishes in volume.

In myocardial disease, even moderate exercise provokes ventricular dilatation.

In other words, the diameters of the heart are maintained by *visceral-tone* (page 451). One first determines the borders of the heart by percussion. The latter is facilitated by forcible extension of the neck during the time percussion is executed (page 228). Next the patient is directed to raise and lower the body a number of times (until slight dyspnea is produced), by flexing the knees.

**Vide* tests on page 215 *et seq.*

If percussion (with neck extended), shows a diminished area of cardiac dulness, the myocardial tone is normal and the muscle is efficient, otherwise the tone is deficient and the muscle is inefficient. In percussion, reliance is only to be placed on the elicitation of the deep or relative dulness (forcible percussion). A method original with the author for testing cardiac tone is described on page 471.

FIG. 118.—Illustrating the author's method of threshold percussion.

The modified *threshold percussion* of the author is available for defining the borders of the viscera. Percussion is executed in the mid-respiratory position. The tip of the index finger of one hand is firmly fixed in an intercostal space at an angle with the chest-wall, but parallel with the boundary that is to be percussed. As the finger gradually approaches the boundary, it is struck with the middle finger of the other hand at its base and side, as indicated by the black spot in fig. 118.

Continental writers, notably Zulawski[91], and Merklen and Heitz[92], find that when the *heart reflex* (page 199), can be elicited in myocardial weakness, it indicates a favorable

prognosis. The former finds that the reflex (by irritating the skin of the precordial region), in the norm reduces the dulness of the heart from 1 to 1½ cm., and the latter show that, in cardiectasis, the reflex may persist for several hours.*

My results are not in accord with the latter observations; it is the duration and not the presence of the reflex which counts. In the norm, the reflex lasts from one-half to three minutes; in myocardial disease, it may persist for hours. In the latter instance, this heart reflex of degeneration corresponds with the reaction of degeneration, viz., a muscular contraction which is tardy and persistent.

Myocardial disease may be suspected even in the absence of cardiac signs, when symptoms not unlike those which accompany the broken compensation of valvular diseases present themselves. A reliable preparation of digitalis may solve the difficulty; if, after five days, the symptoms are not relieved and there is no rise of the peripheral arterial tension nor increased strength of the pulse, the drug can do no good and may even be dangerous. Many preparations of digitalis are practically inert, and this fact may be demonstrated by its physiologic action. Within thirty-six hours after the use of a reliable preparation given in adequate doses, one finds that the pulse becomes stronger, more regular and slightly decreased in frequency (provided the pulse was accelerated before the use of digitalis) and diuresis is augmented. By estimating the quantity of urine excreted one is afforded a guide in a dual direction: the reliability of the drug and the efficiency of the cardiac muscle. In cardiac muscular insufficiency, the quantity of urine may be diminished by one-half or more. Owing to the delayed action of digitalis, an increase in the quantity of urine does not occur until the second day of its use; then it continues to increase day after day until the normal is

*The comparative results obtained from different methods for evoking the heart reflex are shown on page 636.

attained (1500 c.c. in twenty-four hours in a healthy adult); at this time, and when the pulse frequency has been reduced and the tension is increased, one should withdraw the drug, reduce the dose, or give it less frequently.

In using digitalis for diagnostic or therapeutic purposes, the writer first unloads the bowels and diminishes hepatic congestion with a few small doses of calomel. He gives a reliable *fresh infusion of digitalis* in doses of 4 fluid drachms combined with *diuretin* (sodio-theobromin salicylate).

Diuretin is administered in doses of 15 grains; it is a powerful diuretic and antagonizes the vasoconstrictor components of digitalis. The more recent researches of Löwy seem to show that digitalis dilates the coronary and renal vessels. The latter pharmacologic observation, however, is not wholly in accord with the clinical results.

It is often impossible to differentiate between a primary myocarditis and a primary nephritis.

If digitalis causes diuresis, one may conclude that the previous oliguria was caused by a failure in the circulatory apparatus, because its effects are secured by its stimulating action on the heart and blood vessels. If drugs like theocin, diuretin and calomel are effective, we conclude that the effects are attained by direct action on the renal epithelium.

In the differential diagnosis of primary myocarditis and primary nephritis, Winternitz has suggested the catalase test. In chronic nephritis, the catalase of the blood is destroyed, hence, when the latter is brought into contact with hydrogen peroxide, there is absolutely no liberation of oxygen whereas the blood of patients with heart enfeeblement splits peroxide. Others concede the importance of this test only in advanced cases of nephritis either in the uremic or preuremic states.

The symptoms of broken compensation from myocardial disease may be quickly differentiated from a host of other maladies by stimulation of the myocardium by *con-*

cussion of the seventh cervical spine. Even within a few minutes after concussion is executed, cyanosis, dyspnea and other signs of an insufficient myocardium become less evident or disappear for several hours and for a longer interval with repetition of the concussion. To the uninitiated, it is impossible to conceive the great possibilities of this very simple mechanical method of cardiac stimulation. The writer has seen several practically moribund patients with pneumonia in whom the conventional cardiac stimlants were employed without avail, yet these very patients were not only revived but were revived quickly by the method in question. In myocardial disease, when it is a question of fortifying the jaded cardiac musculature, the writer no longer employs drugs but relies solely on concussion of the seventh cervical spine. When the latter fails, the cardiac musculature is no longer capable of restitution.

The real danger with concussion to elicit the heart reflex is its overuse conducing to exhaustion of the myocardium. Concussion should only be used once a day until there is a moderate restoration of the myocardium and then twice or thrice weekly.

This over-stimulation compromises the duration rather than the amplitude of the heart reflex. Thus, concussion of the 7th cervical spine for one minute gives a reflex with an amplitude of 1.6 cm., and a duration of 3 min. and 40 sec., whereas, concussion for 5 minutes yields a reflex with an amplitude of 2 cm., but lasting only two minutes.

Recently, the writer saw a patient with apex pneumonia in consultation with Dr. V. G. Vecki, of San Francisco, the eminent genitourinary specialist. The patient was practically moribund. During the course of her disease, the conventional cardiac stimulants were employed. Suddenly during the night, however, she became extremely cyanotic and pulseless and it was deter-

mined to concuss the seventh cervical spine to awaken, as it were, the enervated heart. No percussion apparatus was at command and, in lieu of the latter, the palmar surfaces of the fingers were applied to the seventh cervical spine, and, with the clenched fist, the dorsal surfaces of the fingers were struck a series of short and vigorous blows (Fig. 2). The latter method of concussion was continued for about ten minutes with intervals of rest. Soon after concussion was commenced, the cyanosis became less evident and the pulse was again perceptible. Every two hours during the night this method was continued and thereafter at less frequent intervals until convalescence was established. It was evident to the nurses and others that after each séance of the concussion treatment there was an immediate evanescence of the cyanosis and the pulse always became stronger and less frequent.

It is conceded that pneumonia is the most fatal of all acute diseases, that there exists no specific medication, and that the most important indication is to maintain the circulation. I am firmly convinced that the systematic execution of the method cited will prove of material aid in hastening recovery from this dread disease, which otherwise may prove fatal.

An efficient percussion apparatus should be at the physician's command in all acute diseases and, as Dr. Vecki[93] suggests, after operations when there is any danger of cardiac implication. I must emphasize, however, the necessity of a suitable apparatus. The latter must give a percussion stroke. All other motions, such as oscillations, shaking, and friction, yield absolutely no results.

In a recent contribution[94], the author has described *Kuatsu* or the Japanese method of restoring life.

Kuatsu, or the restoration of life, is an integral part of jiu jitsu. The latter is usually regarded wholly as a means of physical training and as a method of combat, but when the victim is "knocked out," recourse is had

by adepts to definite methods of resuscitation known as kuatsu.

Many centuries ago, when jiu jitsu was primarily conceived in Japan, kuatsu was used for reviving individuals who were rendered unconscious by the various systems of jiu jitsu, but later it was shown that kuatsu was equally effective in instances of sunstroke, drowning, and injuries from other causes.

It is stated that the adept in jiu jitsu inflicts no injury that cannot be promptly remedied by the aid of kuatsu, whereas our pugilists may inflict blows which may render their opponents unconscious and yet are unable to do anything to revive them. The captious critics of kuatsu seek to dispose of the supposed exaggerated claims of the latter by the derisive observation that the jiu jitsu man is able to restore those whom he kills.

The line of demarcation between life and death is difficult of determination and an individual should, paradoxical as it may appear, only be regarded as dead when it is demonstrated that he is not alive. The extraordinary tenacity of life shown by the exsected heart is really marvelous. By artificial perfusion Kuliabko elicited well marked contractions of the entire heart of the rabbit five days after the death of the animal, and the same authority completely revived the heart of a four year old boy who had died of pneumonia twenty-four hours after death.

A study of the charts in any representative work* on jiu jitsu shows a number of points on the body surface which, when struck, will cause either insensibility or death. The writer has exerted firm pressure over the various points in question and noted that in the majority of instances there was a reflex inhibition of the heart during the period of pressure. The latter effects were more evident when the sphygmograph was employed. The

*A representative work of this character is that of Hancock, *The Complete Kano Jiu-Jitsu*. There are many systems of jiu-jitsu in Japan, but the Kano system has been adopted by the government.

writer has demonstrated elsewhere, however, that the heart may be inhibited reflexly practically anywhere on the body surface, but that the definite points of election are the intercostal spaces, the abdomen, the muscles of the neck, and the region on either side of the spine corresponding to the upper dorsal vertebræ. Irritation of the mucosa of the stomach, nose, and rectum is equally effective in inhibiting the heart, but, if the mucous membranes in question have been previously cocainized, such inhibition does not ensue.

Inhibition of the organ in the foregoing instances, is effected by reflex sensory impulses acting on the vagus, the inhibitory nerve of the heart. The action of atropin and pilocarpin on the heart reflex has been considered on page 454. In kuatsu, the subject is placed in the prone posture with arms extended sideways and the operator with his wrist lands severely upon the seventh cervical vertebra with the regularity of a carpenter striking with a hammer. As soon as the patient recovers consciousness, he is placed in a sitting posture, his arms are rotated, and he is aided in walking. The latter injunction is regarded as mandatory in the application of kuatsu, the object being to completely restore the functions of the circulation and respiration, otherwise, it is said the patient relapses into unconsciousness.*

The resistance of the myocardium in stretching during diastole represents the tonicity of the cardiac muscle. In the normal state stretching of the cardiac parietes is effected by the pressure of the blood which enters the heart from the large veins and is essentially a venous pressure. It follows that in high venous pressure, provided the cardiac tonicity is compromised, a cardiac dilatation must ensue. In the latter condition the amount of residual blood in the heart usually exceeds the systolic output of the organ.

*The minute details of the method are not recounted although regarded as important by authors on the subject. In the opinion of the writer, the essential feature of the method is concussion of the seventh cervical spine.

In the vagus of the frog there is one set of fibres which only influences the heart rate (chronotropic effects), whereas another set increases the force of the contraction and cardiac tonicity without affecting the rate. The latter tonic fibres in the vagus are stimulated by the usual cardiotonics, but the action of the latter is inhibited if the vagi have been cut or paralyzed by atropin. The action of the cardiac nerves has always been a subject of contention.

The vagus slows the action of the heart (inhibitory action), whereas the accelerator nerves quicken the action of the heart. Both nerves in the norm are in tonic activity.

Reference to Fig. 119, shows the origin and course of the cardiac nerves. It will be noted that the spinous process of the 7th cervical vertebra corresponds to the 3d dorsal segment of the cord, which in turn corresponds to the root-origin of the third thoracic nerve.

Concussion is often a more powerful nerve stimulant than electricity and a blow on the head results in photopsia due to stimulation of the optic nerve by the propagated blow.

In concussion of the 7th cervical spine, the blow is transmitted through the spinal nerves to the sympathetic ganglia which form in connection with branches of the vagus, the superficial and deep cardiac plexus, and it is essentially by this indirect stimulation of the vagus that the effects are attained by concussion of the 7th cervical spine.

Aortic contraction in *aneurysms* is effected through the same neuro-medullary pathway.

The writer has shown empirically that the best site for stimulating the vagus and thus increasing the force of cardiac contraction and cardiac tonicity is the spinous process of the seventh cervical spine. The most effective excitant of the heart reflex is concussion, which is a me-

chanical stimulus and that the reflex in question may be elicited with the same certainty and precision as are the reflexes by the vivisectionist in his laboratory.

A just appreciation of the latter facts by the clinician will prove of great value to him in the treatment of myocardial insufficiency and as an aid in resuscitation. They also explain the kuatsu method of reanimation.

In conclusion, I may say for academic purposes only that the heart reflex cited is the heart reflex of contraction. The counter reflex of dilation, has been described on page 221.

FIG. 119.—Origin and course of the cardiac nerves.—Mot, Sens, nuclei of the efferent (motor) and afferent (sensory) fibers of the vagus. C, 1, 2, 3, 4, 5, 6, 7, 8, and T, 1 to 8, cervical and thoracic (dorsal) spinal nerves. SCG, MCG, ICG, superior, middle and inferior cervical ganglia. REC LAR, recurrent laryngeal nerve; CPL, cardiac plexus. T, 3 (inclosed in a circle), corresponds to the spinous process of the seventh cervical vertebra (from Powell and Gibson, slightly modified).

THE HEART REFLEX OF DILATATION, elicited by concussion the last four dorsal vertebræ (concussion of the 10th dorsal spine suffices), is a *dilatation of accommoda-*

tion, owing to an increased volume of blood provoked by such concussion (page 617). Concussion of the third and fourth dorsal spines, or pressure between the latter, reduces vagus-tone (page 472), and eventuates in an *active dilatation*. The heart reflex of dilatation is of little value in practice excepting when the heart is undersized (hypoplasia) in phthisis, advanced valvular disease (specially the left ventricle in mitral stenosis) and in old age (senile heart). Concussion of the 10th dorsal spine should be executed to achieve our object.

When *rapidity of action from drugs* is desirable in diagnostic-therapeutics, much may be expected from the intravenous employment* of *strophanthin*. Thus administered, its action it fully manifested within sixty minutes. Administered by the mouth, its action is not evident for at least seventeen hours. When it is remembered that the physiologic action of digitalis is not manifested for at least thirty-six hours, it is not difficult to note the many advantages accruing from the intravenous employment of strophanthin. A single injection of the latter drug is capable of fully restoring a patient with cardiac incompetency. The dose of strophanthin (a reliable preparation is that of Thomas) is from $\frac{1}{4}$ to $\frac{1}{2}$ mg. (gr. 1-240 to 1-120). It is also procurable in sterile vials.

In suspected myocardial disease due to lues, a positive Wassermann reaction may prove as valuable as the same reaction in the diagnosis of luetic aortic insufficiency and the subsequent therapeutic results with mercury and potassium iodide will clinch the diagnosis.

To appreciate the diagnostic-therapeutic value of digitalis, one must recognize its action which may be divided into two periods: (1) therapeutic stadium, in which the cardiac force is increased; (2) toxic stadium, when such

*To make an intravenous injection, dilate veins of arm with a rubber band above the elbow. Partially fill syringe (free of air-bubbles) with the solution and then insert needle into the median vein. Before injecting, some blood is drawn into the syringe to be sure that the needle is in the vein. Then, the rubber band is removed and the contents of the syringe emptied.

force is diminished. In the first stadium, slowing of the pulse is slight, whereas in the second stadium, it is very much diminished in frequency, and may even become arrhythmic. This excessive slowing of the pulse may be accepted as the primary signal of the toxic action of digitalis. The chief effects of digitalis are exerted on the heart muscle, and the greater the integrity of this muscle, the better the action of this drug on the heart; hence such reaction may be accepted as a diagnostic indication of the condition of the cardiac muscle. Thus, the more intense the myocardial degeneration, the more susceptible is the reaction to small quantities of digitalis. If, instead of securing the physiologic action of digitalis, toxic effects are observed, one would conclude that the myocardial changes were pronounced. In such instances, the use of digitalis is positively dangerous.

The author desires to emphasize the fact that *there are neither exclusive nor specific methods in therapeutics but that the synergistic action of different remedies must be conciliated.*

In awakening the tonicity of an enervated heart, the use of digitalis with diuretin (page 513), may be indicated in association with concussion of the 7th cervical spine when the heart fails to respond to the latter method alone. Concussion is essentially a stimulant to the vagus-fibers which increase the contractility (inotropic) of the myocardium and may be without action on the rhythmicity (chronotropic influence), hence the value of digitalis, which brings about slowing of the heart.

Having achieved our object with the combined digitalis-diuretin prescription, one may dispense with the latter and employ concussion exclusively.

THE HEART AND ITS INNERVATION.—A thorough understanding of this subject has an important influence on our therapeutic efforts. In addition to the vagus nerve, the action of which has already been studied, there

are motor fibers from the sympathetic system, known as the *accelerator nerve* of the heart (Fig. 113). Stimulation of the latter, causes an increase in the rate of beat of the heart, but not infrequently the *force* or energy of the beat may be increased and the rate may remain unaffected. In consequence of the latter effects, physiologists assume that, the accelerator nerve contains fibers which accelerate the rate, and others (augmentors), which cause a more forcible beat. Hering has shown that stimulation of the accelerators may revive a heart that has ceased to beat. The vagi and accelerators are normally in tonic activity. Now, cardiac vigor is not only a muscular but a neuro-muscular question. While muscular tone, as a rule, is secured by vagus-stimulation (the after-effects on this inhibitory nerve being to increase the force of the beat), we have in our discussion ignored the influence of the accelerator nerve. Both nerves are in physiologic antagonism. In a given case of cardiac-insufficiency, it is wise to test the tone of the sympathetic and vagus-fibers according to the methods described on pages 469 and 472, to determine whether our therapy should be sympathicotropic or vagotropic (page 451). In addition to these tests, one may employ the method of demonstrating *abnormal irritability of the sympathetic system.* In the norm, instillation of a drop of a one per thousand solution of adrenalin into the eye has no effect on the dilator pupillæ (page 452), but if the sympathetic system is excitable, pronounced mydriasis follows the instillation (The nerve-fibers for the dilator muscle of the pupil run in the cervical sympathetic and terminate in the superior cervical ganglion). To further demonstrate the value of the author's tests, the following may be cited: A patient fond of coffee, invariably suffers after its use from tachycardia and arrhythmia. Prior to its use, the tone of the vagus was found normal (page 469). Within one-half hour after consuming coffee, the vagus-tone was absent, the heart was arrhythmic and the pulse 120. Within one hour after the use of pilocarpin (gr. 1-10) *per os* the vagus-

tone was restored to normal, arrhythmia inhibited and the pulse reduced to 80. The hypodermatic use of pilocarpin (page 454), is followed by more rapid results.

FORMS OF HEART-FAILURE.

Heart-failure is chiefly a muscular question, although a neuro-muscular factor must not be ignored. In cardiac insufficiency (decompensation), it is the cardiac muscle (myocardium), which fails to do the work of the heart.

1. HEART-FAILURE OF INFLAMMATORY ORIGIN.—This form includes inflammation of the myocardium, endocardium and pericardium.

One of the most common etiologic factors in the inflammatory involvement of these structures is rheumatism. The pyogenic cocci, pneumococcus and gonococcus also play a very important *rôle* in etiology. In fact, metastatic infection is exceedingly common. *Tonsilitis*, heretofore regarded as a trivial affection is now viewed as a grave one, insomuch as it is often the only recognizable cause of endocarditis, polyarthritis and other diseases.

If polyarthritis is caused by suppurating tonsillar crypts, incision or removal of the latter may cause an immediate disappearance of pain and fever. A bacteriologic study of the tonsillar crypts will reveal all kinds of micro-organisms, and the wonder is that the tonsils are not more often accused as factors in the etiology of disease.

2. HEART-FAILURE OF ARTERIOSCLEROTIC ORIGIN.—The circulatory apparatus must be regarded as a unit. In the embryo, the heart is only a blood-vessel and its elaboration into a special organ is only the result of muscular overgrowth which in one situation make a heart and in another, the wall of a blood-vessel.

In arteriosclerosis, the hypertrophy of the heart ensues

from an increase in the peripheral resistance of the blood-vessels. Soon, however, dilatation of the organ ensues, with signs of decompensation (dyspnea on exertion, attacks of cardiac asthma, scanty urine, etc.). It is usual to specify a *renal form* of heart-failure, but such a form is identified with arteriosclerosis in such a way that it is difficult to say which is primary and which is secondary.

3. HEART-FAILURE FROM OBESITY.—Oertel first explained the effects of obesity on the heart and blood-vessels. Indeed, heart failure is more frequently encountered in fat than in lean individuals.

A fatal error is often made in the treatment of these cases when an attempt is made to execute a reduction-cure without first strengthening the myocardium. Naturally, one must eventually reduce the weight, but care must always be exercised to reduce gradually and to avoid subalimentation. It is better to provide the patient with about 1,600 calories a day to attain our goal more slowly.

Thyroid intoxication, the cardiac neuroses, in fact any cause operating to increase unduly the work of the heart eventuates in failure of the organ.

Heart-failure from *syphilis* (congenital or acquired), is not infrequent. Some forms of myocarditis are always syphilitic. In the presence of symptoms of cardiac insufficiency in a subject with a history of syphilis, the latter as an etiologic factor is not only possible, but probable.

Here the use of mercurial inunctions is indicated:

In *Pulmonary Edema*, the tonicity of the right ventricle is implicated and its dilatation is manifested by cyanosis, dyspnea and pulmonary edema.

Referring to page 202, one finds that the myopathic heart reflex only influences the right ventricle of the heart. Percussion of the muscles is a puissant method of treatment in pulmonary edema.

CARDIAC MURMURS OF FUNCTIONAL ORIGIN.

Perhaps no fallacy in medicine has been more sacredly perpetuated than the belief that a cardiac murmur is always indicative of a disease of the heart. Some of the most serious heart-affections are unaccompanied by murmurs. "The idea that a murmur in itself and by itself is a serious thing dies hard." (Shattuck).

Sir Andrew Clark gave utterance to the truism that "a murmur in itself is of little or no moment in determining the prognosis of any given case." Osler voices the opinion of the skilled cardiac diagnostician as follows: "Practitioners who are not adepts in auscultation and feel unable to estimate the value of the various heart-murmurs should remember that the best judgment of the conditions may be gathered from inspection and palpation. With an apex-beat in the normal situation and regular in rhythm, the auscultatory phenomena may be practically disregarded." Fowler is responsible for the epigram: "The position of the heart-apex is the key to the diagnosis of nearly all affections of the chest and heart."

FUNCTIONAL AORTARCTIA AND AORTECTASIS.—These terms refer respectively to contraction and to dilatation of the aorta. It is known that, when the lumen of an elastic-walled tube through which liquid flows is narrowed, eddies are created which cause the walls of the tube to vibrate and eventuate in a palpable thrill and a blowing sound called a *murmur*. The latter is loudest below the narrowing and is transmitted in the direction of the flow.

By means of the *aortic reflexes* (page 254), one may contract or dilate the aorta.

If, after auscultating the aortic sounds, one executes concussion of the spine of the 7th cervical vertebra (reflex of

contraction), and again auscultates, a *systolic aortic murmur* is usually heard, varying in duration from one-half to three minutes. The murmur replacing the systolic tone is of longer duration than the latter. It is observed in the norm in children as well as in adults and is equally pronounced in arteriosclerosis of the aorta. My primary endeavor to utilize this auscultatory sign as an evidence of loss of elasticity of the aorta was therefore futile. The murmur in question is the result of temporary aortarctia (aortic contraction), superinduced by elicitation of the aortic reflex of contraction, and it may be dissipated at once by provoking the counter aortic reflex which dilates the aorta.

In several instances only, was the author able to create a diastolic aortic murmur by elicitation of the aortic reflex of dilatation.

Reflex of the Pulmonary Artery.—As a rule, simultaneously with the creation of a systolic aortic murmur, a systolic murmur was also audible over the pulmonary artery. Indeed, it was often heard in the latter situation, although inaudible over the aorta. It was specially loud in children. Like the aortic systolic murmur, it was at once dissipated by elicitation of the aortic reflex of dilatation (concussion of the 4 lower dorsal spines). Although the pulmonary artery eludes percussion, the auscultatory evidence just cited would seem to show that there are likewise two reflexes of the pulmonary artery, *viz.*—contraction and dilatation.

Deductions.—Aside from the inestimable value of the aortic reflex of contraction in the treatment of aneurysms, the reflexes of the pulmonary artery and aorta subserve a useful object in diagnosis. Thus dilatation of these vessels may exist, for the calibre of the large arteries is never constant.

If, then, at an inauspicious moment, one were to auscul-

tate either artery and a diastolic murmur were heard, a faulty diagnosis would be made. Such diagnostic errors are frequent. However, having recognized the physiologic rhythmicity of the large vessels (page 620), one would at once execute the method for provoking contraction of these vessels by concussion of the 7th cervical spine and the diastolic murmur would be dissipated if it were wholly caused by dilatation of the large vessels.

Similarly, a systolic murmur caused by narrowing of the aorta and pulmonary artery would evanesce after concussion of the spines of the four lower dorsal vertebrae.

The auscultatory phenomenon with reference to the reflex of contraction of the pulmonary artery directs our attention to the incorrect apodictic pronunciamento of some physiologists who aver that the pulmonary blood-vessels are unprovided with vasomotor nerves. From what has preceded, the pulmonary artery must be under vasomotor control.

Dr. H. C. Sawyer, of San Francisco, directed my attention to the fact that in the treatment of aneurysms of the thoracic aorta by the author's method of concussion of the 7th cervical spine, aneurysmal murmurs would disappear for a variable period of time after treatment. Even the patient who was conscious of the murmur noted its disappearance for about four hours after treatment. Since my attention was directed to this sign by Dr. Sawyer, I have also observed the temporary disappearance of the thrill. In a number of instances, however, the aneurysmal murmur did not completely disappear, but only became less loud.

Murmurs are so commonly encountered without valvular lesions that Laennec was constrained to conclude that they were of no diagnostic importance, whatever. Laennec's observation is worthy of citation, despite its falsity, in direct-

ing attention to the frequency of functional or accidental murmurs.

Potain found accidental murmurs in one-eighth of all the patients seen in his hospital service.

Many theories have been suggested in explanation of the accidental murmurs, but the author believes, based on the maneuvers suggested for their creation and disappearance, that they are caused by a functional stenosis or dilatation of the aorta and pulmonary artery. Later (page 604), we shall learn the relation of functional pulmonary stenosis to tuberculosis.

> Careful percussion of the thoracic aorta by the author, together with measurements of the vessel by the orthodiagraph several times a day on the same patient, show the variations in the calibre of the aorta in accordance with the law that, each part of the body receives an amount of blood necessary for its activity. The diagnosis of *murmurs of relative valvular insufficiency* has been noted on page 209.

INHIBITION OF THE HEART (page 228)—This phenomenon may be utilized in diagnosis. It may be elicited by extension of the muscles of the neck (Fig. 65), or by contraction of the abdominal musculature (page 208). The employment of the phenomenon is based on the fact that the loudness of a murmur is largely dependent on the activity of the heart. Thus, in weakness of the heart in febrile diseases and the dying state, murmurs become less loud or disappear. During the time inhibition is properly executed, cardiac tones and murmurs diminish in intensity. A few seconds usually elapse before the effect on the heart becomes manifest, then, while the subject is still inhibiting the organ, the heart tones become less and less evident, assuming an embryocardial character, until finally they are no longer audible.

My investigations with this method may be summarized as follows:

1. Organic murmurs become faint and almost inaudible.
2. Transmitted murmurs are more amenable to inhibition and when they are inhibited, the tones which they mask can be auscultated.
3. The fainter the murmur, the more easily it is inhibited.
4. Heart-tones are less amenable to inhibition than murmurs.
5. Functional, are more easily inhibited than organic murmurs and when tones replace the murmurs, the functional nature of the latter is determined.
6. Incorrect execution of inhibition will intensify rather than diminish murmurs and repetition of the maneuver eventuates in futile results owing to exhaustion of the vagi.

INTRA-ABDOMINAL INSUFFICIENCY.—The frequency importance and neglect to recognize this condition prompts the author to make supplementary observations in addition to those cited on page 145. The condition in question is practically identical with Glénard's disease (page 349), but if the physician is guided in the diagnosis of this affection by the palpation of prolapsed abdominal viscera, intra-abdominal insufficiency will often escape recognition. In association with the signs noted on page 145, one seeks for the symptoms identified with intra-abdominal venous congestion (page 427).

Cardioptosis or ptosis of the heart is a participating phenomenon of intra-abdominal insufficiency. The position of the diaphragm and with it the heart, is influenced by intra-abdominal tension. The latter is maintained by pressure of the atmosphere on the yielding abdominal parietes and

contraction of the abdominal muscles. Artificial reduction of intra-abdominal pressure by means of a large vacuum cup applied to the abdominal wall will often, as long as suction is maintained, cause the appearance of *systolic pulmonary and aortic murmurs*. The former, however, less frequent than the latter.

The systolic aortic murmur of cardioptosis is associated with signs peculiar to the latter, *viz.*, cyanosis, dyspnea on exertion or in certain attitudes, and weight or oppression in the lower sternal region or epigastrium. The disappearance of the cardiac murmur and the temporary relief afforded by lifting the abdomen and the almost immediate and permanent relief following the wearing of a proper abdominal support, with the chief pressure at the *umbilical region*, are diagnostic-therapeutic signs.

It is surprising to note the large number of individuals with neurasthenic and digestive symptoms caused by *intra-abdominal insufficiency*. These patients are treated futilely for every conceivable condition but the right one. In advanced grades of the condition, the "*habitus enteroptoticus seu paralyticus*" may be recognized. Stiller insists that a fluctuating or floating tenth rib (*costa decima fluctuans*) is pathognomonic of this condition. In Stiller's book, "The Asthenic Diathesis," he shows that the patients digest quite well until fatigued. *Mucous colitis* is often associated with the condition. Mere inspection may enable one to make a diagnosis when the patient is standing, viz., long and flat thorax with narrow epigastric angle, retracted and flat abdomen in epigastrium and protuberant lower abdomen. Prolapsed organs may be palpated in the recumbent posture.

These patients are best treated by hyperalimentation and an abdominal support. We must not forget however, that the victims of intra-abdominal insufficiency may be obese as well as emaciated.

Before a permanent abdominal support is obtained, one may temporize with Rose's method of strapping the abdomen for determining whether gastric, cardiac, neurasthenic and other symptoms are dependent on intra-abdominal insufficiency. The plaster may be worn for a week or longer. Z. O. adhesive plaster on moleskin (Johnson and Johnson) is used, seven inches wide and as long as the circumference of the waist measure of the

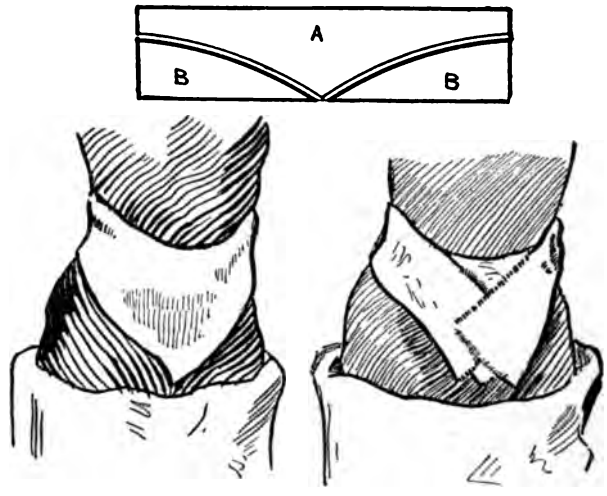


FIG. 120.—Illustrating the method of Rose in the application of the plaster bandage. The figure above shows the method of cutting the plaster and the other figures show respectively, the method of applying the strip A, and the strips B, B, which complete the bandage.

patient. This plaster is cut into three pieces according to figure. The abdomen is shaved and washed with ether. The large piece is first applied, the point being placed over the symphysis, the ends meeting and overlapping in the back. The plaster should be applied above the crest of the ilium. Then the side-pieces, which run from the hypogastrium over the iliac and inguinal regions and unite at the spine, are applied with considerable force.

I usually apply the plaster in the Trendelenburg position although the dorsal posture may be used, the abdominal viscera being raised by an assistant during the time the plaster is tightly approximated to the back. The removal of the plaster is facilitated by benzine or oil of wintergreen.

Another method[100], more satisfactory than the latter for supporting the abdomen is the following which is illustrated in Fig. 121.

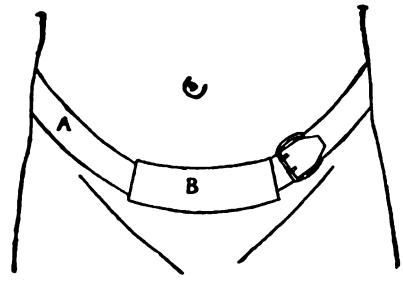


FIG. 121.—Illustrating a method for supporting the abdomen. A indicates double-padded bandage and B, zinc oxid strip.

"A strip of zinc oxid adhesive plaster 2 or 2½ inches wide and about 5 or 6 inches long, the length varying with the size of the patient, is placed transversely across the extreme lower abdomen as nearly as possible to the pubes, the hair having been shaved clean for this purpose. To each end of this strip of adhesive plaster is attached a bandage of about the same width, long enough to reach around the body above the iliac crest, and be tied or otherwise fastened behind, or better, one end long enough to reach around and fasten at opposite end of plaster. If the ends of the plaster have a tendency to become loosened and pull up by traction of the bandage, this can be prevented by a narrow verticle strip across each end of the adhesive strap and applied to the skin above and below. The bandage itself is well padded with cotton, either folded within it or applied to the body imme-

diately beneath it. This prevents any irritation of the skin from the bandage and permits of its being drawn as tightly as necessary in order to furnish the necessary support from below."

The point of pressure in the lower abdominal area gives the greatest amount of support. Where the plaster approximates the skin, a thin layer of collodion to the latter may precede the application of the bandage.

Any abdominal condition causing the diaphragm to be forced upward may cause functional murmurs and the horizontal position of the heart with an apparent increase in the transverse diameter may still further complicate the situation.

SUBCLAVIAN MURMURS.

Subclavian murmurs are frequently misinterpreted as evidence of an aneurysm or cardiac disease. The literature on the subject is meager and indefinite and for that reason I may be pardoned for interpolating my investigations.

From the literature the following facts were gleaned:

Subclavian murmurs are sounds heard over the subclavian artery which are dependent on the phases of respiration. They are usually best heard at the height of inspiration, less often at the end of expiration. When very intense, they may be recognized by the finger as *frémissement*. They are heard more often on the left than on the right side, rarely on both sides, and least often on the right side. English practitioners of medicine have been especially prominent in the study of the phenomenon, and have regarded it as a clinical sign of pulmonary tuberculosis when it is only manifest on one side. This opinion was combated by Fuller and Palmer. The former found the subclavian murmur twelve times among one hundred healthy persons, whereas Palmer found it to exist thirty-seven times among one hundred and twenty-nine healthy laborers.

MECHANISM OF THE SUBCLAVIAN MURMUR.—The mechanism of its origin has not been made definite, although it has been variously attributed to compression of the subclavian artery by the elevation of the first rib in inspiration or to the action of the subclavius and scaleni muscles. Friedreich, observed the subclavian murmur most frequently among phthisical individuals, and suggested as a cause, the occurrence of adhesions between the vessel wall and the lung pleura, which led to a narrowing of the artery in one or both phases of respiration. He contended that, insomuch as pleural adhesions were not infrequent, even among healthy persons, he was constrained to conclude that such adhesions sufficed to explain all subclavian murmurs, the extent and direction of the synechiæ determining the occurrence of the murmur during inspiration or expiration. From an examination of more than three hundred persons, I am able to formulate the following conclusions:

1. The subclavian arterial murmur is an independent (autochthon) and rarely a transmitted murmur.

2. Its point of maximum intensity is the fossa of Mohrenheim, with feeble tendency to propagation. The fossa of Mohrenheim is that depression under the clavicle in the outer part of the infraclavicular region between the pectoralis major and deltoid muscles.

3. It is heard most often on the left side, less frequently on both sides, and least frequently on the right side. In order of frequency it is heard at the height of inspiration, at the end of expiration, and after momentary suspension of respiration.

4. It is usually a succession of murmurs uniform in character and intensified by certain maneuvers, notably deep inspiration, forced expiration, suspension of respiration, and voluntary stretching of the neck.

5. One of the chief characteristics is its momentary duration, disappearing usually after a few deep inspirations.

6. Its dependence on the phases of respiration distinguishes it from all transmitted murmurs.

7. It may be present at one and absent at a subsequent examination, and neither its character nor duration is ever uniform from one examination to another.

8. The position of the patient may influence its genesis, but this is never sufficiently uniform to be of practical value.

9. A phthisical lung is not specially propitious to its occurrence, as it is found nearly as often in healthy as in phthisical persons.

10 It was present in 36 per cent. of all healthy persons examined, advantage being taken in this enumeration of re-examinations and those propitious factors which determine its occurrence, *viz.*, respiration and decubitus.

11. The venous subclavian murmur was only heard in six individuals with a preponderance of its occurrence on the right side.

12. The arterial subclavian murmur could be artificially induced on the left side in nearly 80 per cent. of all individuals examined, and on the right side in about 65 per cent. of the cases by a simple maneuver, viz., raising the arm gradually until it assumes a vertical position, while auscultating the Mohrenheim fossa during the time that the arm is brought to the latter position, the murmur suddenly appearing at some time during the execution of the movement.

13. By the foregoing maneuver the subclavian venous murmur could be induced on the right side in 43 per cent. of all persons examined.

ANATOMIC CONDITIONS.—To explain the origin of the subclavian, arterial, and venous murmurs, a short excursion into the realms of anatomy is necessary. The right subclavian artery arises from the arteria innominata whereas the same vessel on the left side arises from the end of the transverse portion of the arch of the aorta. The left subclavian artery is longer than the right and

directed almost vertically upward, instead of arching outward, like the vessel of the opposite side. The inner aspects of the upper lobes of both lungs are occupied by grooves, one on each side, for the subclavian vessels, where they are invested by the pleura. The third portion of each subclavian artery on the outer surface of the first rib, and at the lower border of this bone becomes the axillary artery. The points in connection with the first rib that suggest attention are the tubercle and ridge, which serve for the attachment of the scalenus anticus muscle, the groove in front of it transmitting the subclavian vein, that behind it the subclavian artery. Both subclavian veins, which are the continuation of the axillary veins, unite with the internal jugulars to form the right and left vena innominata. If we auscultate the subclavian artery, we hear, in the majority of cases, just as we do in listening over the carotid, two clear tones, one corresponding with the filling of the vessel, the diastolic, and the other with the emptying of the vessel, the systolic tone. Less often only one tone is heard, which is usually coincident with the systole of the blood-vessel. The tones thus heard are the transmitted first and second aortic tones. If we press moderately with the stethoscope, let us say, the carotid artery, we hear a pressure-murmur corresponding to the arterial pulse; by stronger pressure, which almost, but not quite, closes the artery, this murmur is changed into a tone, the so-called pressure-tone. With these preliminary facts at our disposal, we can make explicable the subclavian murmur as heard in health. The following facts demand solution:

1. Why is the subclavian murmur heard loudest during forced inspiration and expiration?

2. Why is the murmur of short duration, disappearing after a few deep inspirations?

3. Why is the murmur heard more often on the left than on the right side?

Factors Necessary for Its Production.—The essential factor necessary in the production of the subclav-

ian murmur is a moderate narrowing of the lumen of the blood-vessel. The recorded frequency of the subclavian murmur in phthisis, and its explanation that pleural adhesions are responsible for its occurrence, is in a measure untenable, for such a condition presumes a narrowing of the blood-vessel that would be persistent at some phase of the respiratory act. My observations show that the murmur occurring in phthisis is just as transitory as it is in health. Moderate narrowing of the subclavian artery occurs during forced inspiration. This is a fact which is easily demonstrable in almost any individual by palpation of the radial pulse. In not a few instances deep inspiration will cause the radial pulse, especially the left, to disappear. The *paradoxic pulse* has lost much of its clinical significance as a diagnostic aid in mediastino-pericarditis, since observations have shown that in health distinct respiratory changes in the pulse are demonstrable by means of the sphygmograph. The sphygmogram shows a fall in the pulse-curve during inspiration and a rise during expiration. Deep, prolonged inspiration, by elevating the first rib, effects compression of the subclavian artery, which accounts for the murmur, which is really a pressure-murmur. Violent contraction of the muscles of inspiration or forced contraction of the muscles which draw the shoulder forward while the arm is at the side will change the murmur into a tone—the pressure-tone. The occurrence of the murmur only during expiration may be explained in part by the fact that after the artery is excessively compressed by the act of inspiration, this pressure is in part removed during the beginning of expiration, which act converts a pressure-tone into a pressure-murmur. Then again the blood-pressure must be taken into account during the expiratory act. Stretching of the neck, which will sometimes elicit the murmur, is explained by the action of the scalenus medius elevating the fifth rib. The short duration of the murmur finds explanation in the artificial production of the pressure-murmur in the normal artery. Here, as in

the normal artery, the ever-increasing narrowing of the lumen of the subclavian artery will convert a murmur into a tone. This is practically what occurs during forced inspiration, for a murmur heard during the beginning of the inspiratory act may no longer be audible at the end of that act. Then again attention must be directed to a condition (page 299), which Kernig and myself have described, *viz.*, a complete dulness of the lung-apices without any structural change in the lung. In many healthy persons this condition is manifest. It is not difficult to conceive that the subclavian artery would be more effectually compressed by an atelectatic upper lung-lobe than by an aerated lobe. After a few deep inspirations the subclavian murmur is no longer evident, owing, perhaps, to the fact that the apices becoming more aerated offer less resistance to the superimposed arteries. The more frequent occurrence of the murmur on the left side finds facile explanation in the anatomic differences between the two arteries; the left reacting more easily than the right subclavian artery to the influence of those factors which conduce to compression of the blood-vessels.

Means by Which the Murmur May Be Elicited.—The method I have advocated for eliciting the subclavian murmur is simple. Placing the pectoral end of our stethoscope in the fossa of Mohrenheim, we listen for the subclavian murmur. If the latter is not heard, we slowly raise the arm of the patient corresponding to the side auscultated until it is audible. The murmur may not be demonstrable until the arm is elevated to a level with the shoulder or until it assumes a vertical position. This maneuver evokes the subclavian phenomenon by narrowing the lumen of the subclavian artery, for coincident with the elevation of the arm the radial pulse becomes less and less evident, until, when the arm has attained the vertical position, the pulse is no longer palpable. This diminution in the pulse-volume is more manifest on the left than on the right side. In a certain percentage of persons ex-

amined, the maneuver of raising the arm gave rise to a subclavian venous instead of an arterial murmur, while in other persons both murmurs were distinctly audible. The soft, musical, continuous hum of the venous murmur cannot be confounded with the arterial murmur. Like the artificial venous murmurs produced by pressure of one of the large veins by means of our stethoscope, so may the subclavian venous murmur be explained, *viz.*, that by raising the arm we elevate the first rib, which in turn narrows the subclavian vein. The more frequent occurrence of the subclavian venous murmur on the right side is explained in the same way as we explain the increased irequency of the jugular venous murmur on the same sfde.

ANGINA PECTORIS.*

Anginoid pains are symptomatic of a variety of cardiac affections and are equally independent of the latter. We shall first differentiate the so-called varieties of angina pectoris (stenocardia).

1. ANGINA ABDOMINIS.—Here, the spasm is confined to the vessels innervated by the splanchnic nerve, causing an enormous increase of blood-pressure. Even in true angina there are attacks of abdominal pain suggesting gall-stone colic.

2. ANGINA PECTORIS VASOMOTORIA.—Here, there is no primary cardiac lesion, but a wide-spread arterial spasm with secondary anginoid pains. The peripheral angiospasm causes paresthesias in the hands and feet, and if the pale and cold (often cyanotic) extremities are warmed, or if the patient walks, anginoid pains are inhibited.

3. ANGINA PECTORIS FROM CORONARY SCLEROSIS.—In this true form of the disease the lesion in the majority of

**Vide*, page 221, *et seq.*

instances is an arteriosclerosis of the coronary arteries. The pains are probably caused by an ischemia of the myocardium (page 222), which fact is supported by the observation that the pains diminish in frequency as age advances, owing either to muscular insufficiency or because the too-rigid vessels do not permit of vasoconstriction.

ETIOLOGY OF ANGINOID PAINS.—Practically any painful abdominal affection, notably gastric ulcer, may simulate the pains of angina pectoris. In *endocarditis* and perhaps in *obesity* (if coronary arteriosclerosis is not present), narrowing of the coronary vessels may conduce to attacks of angina. *Pericardial adhesions* may also narrow the lumina of the vessels. *Syphilis of the heart* is not an infrequent factor. Probably the lesion is more often aortic (implication of the region corresponding to the origin of the coronary arteries). Here, antisyphilitic treatment may establish the diagnosis. *Tabes dorsalis* (cardiac crises), *gout*, *diabetes*, *lead poisoning*, *hyperthyroidism*, *autointoxication* and *nervous affections* may cause anginoid pains.

Tobacco is no doubt a frequent etiologic factor in angina. When tobacco or alcohol is the problematic cause, the presence of *scotomata* (blind spots in the visual-field), will clinch the diagnosis.

> *Test for scotomata.*—Let patient with one eye closed look steadily at tip of physician's nose at a distance of about two feet; then take any green or red colored object (wool or card board), about 2 to 5 mm. in diameter, and move it from the periphery to the point of fixation; when the object arrives at the scotoma (seat of defect in the visual-field), it will appear dull or colorless. Green is usually less readily perceived than red.

Osler,[95] presages an increasing number of cases of angina pectoris (cardiac neuralgia), corresponding with the rapid

increase of cigarette smoking among women. He observes that very heavy smokers may die from vagus-inhibition.

In investigating the influence of tobacco on the heart, I noted that in some individuals the blood-pressure was reduced and in other instances, it was raised. The effects thus produced corresponded to its sedative or stimulating action. The chief effect, however, was on the cardiac musculature, tobacco eliciting a veritable heart reflex lasting from one minute to several hours. This effect was accentuated when the tobacco was inhaled and partially inhibited when the smoke was filtered through cotton. The effects varied with the kind of tobacco smoked. Thus, in some individuals, Havana tobacco produced a marked retraction of the left ventricle, whereas, Turkish tobacco was without any effect.

In my investigations, the effects of tobacco were not only tested with reference to the heart reflex but by other methods for testing vagus-one (page 469).

Insomuch as tobacco is a vagus-tonic, I do not prohibit its use among my patients who suffer from aneurysms or myocardial affections (excluding angina pectoris).

To illustrate my investigations, the following two cases are cited:

CASE I

	AMPLITUDE OF RETRACTION OF LEFT VENTRICLE	DURATION OF HEART REFLEX
a. Havana cigar partially smoked	*a*. 3.5 cm.	*a*. 2 min.
b. Same cigar smoked through cotton in a holder	*b*. No retraction.	
c. Manila cigar without cotton	*c*. 4 cm.	*c*. 4 min.
d. Manila cigar with cotton	*d*. 2 cm.	*d*. 3 min.

CASE II

Same condition as *a*	2.5 cm.	2 min.
Same condition as *b*	No retraction.	
Same condition as *c*	4 cm.	7 min.
Same condition as *d*	No retraction.	

It is quite probable that anginal pains from tobacco are caused by ischemia of the myocardium superinduced by the heart reflex.

Anginoid pains are not infrequent in *aneurysms* and Osler refers to angina pectoris as an early symptom of the disease, due probably to overstretching of the aorta.

Here, concussion of the seventh cervical spine (which contracts the aorta), will cause an immediate evanescence of the pain, whereas, the maneuver, which likewise contracts the heart will increase the pains in true angina (page 223).

With increasing experience in the treatment of angina pectoris, the author is constrained to make a dogmatic differentiation of the disease into two forms: Angina, without and with an increase in the diameters of the heart.

ANGINA WITHOUT DILATATION.—It is not only necessary to demonstrate that the heart is not dilated, but also to establish the fact by the method cited on page 510, that the myocardium is efficient. When the myocardium is efficient and the heart is not dilated, the angina is probably caused by coronary arteriosclerosis. If examination shows a dilatation of the organ and an inefficient myocardium, the pains are caused by an acute or chronic dilatation of the heart.

I shall differentiate these two forms as cardio-tonic (no increase in cardiac diameters), and cardiectatic angina pectoris.

The tone of the myocardium, as has already been shown (page 471), is maintained by vagus-tone, and any increase in the latter will precipitate a cardio-tonic paroxysm of angina. It is in this way only that one may explain attacks caused by the action of digitalis, pilocarpin and concussion of the 7th cervical spine, which increase vagus-tone. Atropin inhibits the pains of the cardio-tonic variety and accentuates the pains of the cardiectatic forms.

Concussion of the 7th cervical spine will cure the cardiectatic forms.

By inhibiting vagus-tone (concussion or sinusoidalization of the region corresponding to the third and fourth dorsal spines), the author has achieved promising results in the treatment of cardio-tonic angina pectoris. This corresponds to the method on page 221, for eliciting the heart reflex of dilatation; the dilatation by this method being to evoke an active dilatation of the organ (page 520).

CARDIECTATIC ANGINA PECTORIS.—Investigations by Hyde, in Porter's laboratory, show that dilatation of the heart alone will diminish the flow of blood through the coronary arteries. It is for the latter reason that the pains associated with dilatation may be subdued by withdrawing some blood.

Among the soldiers of the Civil war, da Costa noted precordial pains of anginoid intensity, due to overstrain and dilatation of the heart. Acute cardiac dilatation, such as is observed after physical exertion (climbing, dancing, rowing, running, etc.), causes anginoid pains.

Within a few days, treatment by concussion causes the disappearance of symptoms peculiar to dilatation of the heart.

> The following case of a San Francisco physician is cited to illustrate the importance of recognizing the cardiectatic variety of angina pectoris. My stenographer's verbatim report from the physician is as follows: "My age is 52 and weight, 172 pounds. Several prominent physicians (names suppressed) diagnosed my case as one of true angina pectoris and I was doomed to live a life of hopeless invalidism. My father suffered from similar attacks of anginal pains which began at my age. He was like myself inclined to *obesity*. I am forced to give up my outside practice, because the least exertion in walking and particularly when the *cold air strikes my*

chest brings on severe and radiating pains with a feeling of fear and oppression."

In this patient, the cardiectatic variety of angina was demonstrated. Within three weeks, the patient was able to resume his practice and up to the time of writing could make any physical exertion without any recurrence of symptoms. Concussion of the seventh cervical spine (daily séances, ten minutes) was the only treatment employed. Provision later, however, was made for a gradual reduction in weight for it is impossible to fully reconstruct cardiac musculature immersed in an atmosphere of fat. The fact that the patient's father had similar attacks at his age only emphasized heredity in relation to the tendency to corpulency which impaired the integrity of the cardiac musculature.

The fact in the previous history, that "*cold air striking the chest*" precipitated an attack, led me to investigate this phenomenon which is by no means uncommon in angina pectoris. Some patients also suffer from attacks when cold air is inspired. I found that when a current of cold air is directed over the precordial region, *the heart dilates*. In the norm this dilatation is slight, but it is exaggerated in cardiac insufficiency. Inhalation of cold air produces a like, though less pronounced effect. This heart reflex of dilatation (pages 221 and 520), like its counter reflex of contraction, is mediated by the vagus, for, when the latter is inhibited (pressure between the 3d and 4th dorsal spines), no reflex can be elicited A current of warm air over the heart is neutral in action.

The foregoing observation is of great physiologic and therapeutic value. As a rule, cold air impinging on a visceral area is in the nature of a cutaneous irritant and one would premise that the result would be a contraction of an organ, like the heart reflex of contraction and other visceral reflexes. It was found that cold air similarly used, *dilated the stomach, spleen and liver*. The physiologist

has extended the scope of the cutaneous sensory nerves by not only endowing them with the sensation of touch, but of pressure, warmth, cold and pain. He must now recognize the puissance of *specific cutaneous nerves* (page 465), which influence visceral-tone; nerves, which in response to a special irritant, will either contract or dilate an organ. A better understanding is also had of percutaneous medication. Thus, Short and Salisbury[96], endeavor to show by scientific investigations that applications to the skin (ointments, lotions, plasters), are absolutely without value as determined by methods of testing the cutaneous sensations. In fact, many recognized local anesthestics applied to the unbroken skin rarely produced an anesthesia. In view of the author's observations, such investigations which do not take the visceral reflexes into consideration are futile. It is known that, stimulation of the respiratory center is greater through the cutaneous nerves than through the branches of the vagus to the respiratory organs.

DIFFERENTIAL DIAGNOSIS OF CHEST-PAIN.

It is by no means always easy to differentiate the pains of angina pectoris from other chest-pains, insomuch as there are many grades of true angina. Two factors make up a typic anginal paroxysm: pain (*dolor pectoris*), located in the sternum and radiating to the arm (usually the left), and a feeling of anguish and sense of imminent dissolution (*angor animi*). Among other typic signs are: increased blood-pressure, sensory areas of the skin (Figs. 23 and 24), and the relief of the paroxysms by amyl nitrite (page 226), or other vasodilators.

Chest-pain may be caused by diseases of the heart, pericardium and vessels, pleura, lungs and bronchi, mediastinum, esophagus, intrathoracic nerves and nerves of the chest-wall, bones, joints and periosteum, mammary glands,

skin and muscles. Space will not permit me to discuss all these varieties of pain.

INTERCOSTAL NEURALGIA.—Fully 95 *per cent.* (analysis by author of 1,000 cases), of all cases of chest-pain are caused by intercostal neuralgia (Chapter VI), and the immediate relief by paravertebral freezing constitutes one of the most brilliant triumphs of therapeutic medicine.* This form of neuralgia is observed more often on the left than on the right side, owing, as Henle supposed, to the fact that the veins on the right side pour their blood into the great veins by a less circuitous route.

Occasionally one finds intercostal pains secondary to intrathoracic tumors, aneurysms, diseases of the spinal cord and its membranes and *skeletal mal-alignment* (foot-note, page 186 and page 123).

Pains simulating intercostal neuralgia may be one of the frontier symptoms of *gastric cancer* and are caused by infiltration of the paravertebral tissues.

In the foregoing instances, freezing is negatively diagnostic, insomuch as it affords no relief.

> According to *Wolf's Law*, which is generally accepted, every change in the form and function of the bones, or of their function alone, eventuates in definite changes in their internal and external configuration in conformity with the laws of mathematics. The shape of a bone is caused by the function it performs. In this sense, skeletal mal-alignment may be produced by improper static conditions. Intercostal and other neuralgias (notably, sciatica) may be caused by changes in verte-

*For the relief of pain in the intervals of freezing, the author employs the following efficient analgesic formula for a single dose, which may be repeated if necessary: Caffein, grains, 2; pyramidon, grains, 5; phenacetin, grains, 5; sodium bicarbonate, grains, 10; sodium bromid, grains, 20. Owing to their deliquescence, the powders are dispensed in homeopathic vials.

bral alignment alone. As a rule, in such instances, *sciatica* is secondary to lesions of the sacro-iliac joints (page 111), for, when there is any restriction in the movements of the vertebral column, there is either an increase in motion in the sacro-iliac joints or there is a change in the inclination of the pelvis.

Mal-alignment of the vertebræ of static or muscular origin (page 123) will exert pressure on the spinal nerves at their exit from the intervertebral foramina.

This can be easily demonstrated on a cadaver or by the insertion of cylinders of wax in the foramina. Such pressure is equivalent to stimulation, notably if there is any anomaly of the spinal nerves.

Weir-Mitchell has demonstrated that a nerve subjected to a thermic insult becomes swollen, congested and hemorrhages occur in the nerve.

On page 123, reference is made to albuminuria caused by lordosis.

My investigations show that, albuminuria is really caused by traction or pressure on the lumbar nerves. If one makes continuous pressure on either side of the second lumbar spine for about three minutes, one may even in the norm detect the presence of traces of albumin in the urine by aid of Tanret's reagent.

About fifteen minutes Faradization of this region will as a rule, effect the same object and when the urine already shows albumin as in nephritis, its quantity is very much increased.

When the pains implicate an extremity, it is important to differentiate *radicular pains* from pains of a nerve trunk.

Here, the essential point in differential diagnosis is in the distribution of the hypoesthesia or anesthesia as determined by the objective examination. A nerve-trunk represents a combination of an anterior motor and a posterior sensory root, and the latter in their intraspinal course are in relation with the dura mater and the vertebræ. If a lesion involves the sensory root within the

column, the sensory disturbance ensuing will have a radicular distribution.

In affections of a peripheral nerve-trunk, the sensory disturbance is distributed irregularly in a longitudinal or oblique direction whereas when the root of the nerve is involved, the hypoesthesia or anesthesia represents a regular longitudinal distribution parallel with the axis of the limb.

Freezing aids in differentiating pains of peripheral and central origin (page 188) or the peripheral nerve-trunk may be blocked. Thus in *sciatica*, a perineural injection into the nerve may be made with 50 cc. of normal salt solution containing one grain of beta-eucain. The injection is made at the gluteal fold, midway between the tuberosity of the ischium and the great trochanter. The needle should be about 3 inches in length and should be directed upward and slightly inward. When the nerve is reached by the needle, there is a slight twitching of the leg. This injection is curative as well as diagnostic.

The following case of a physician is cited to illustrate a sensory phenomenon, which I have frequently noted, when there are several sources in the excitation of pain.

For about five years, the patient suffered from agonizing paroxysmal pains radiating from the precordium to the neck and left arm. The attacks were associated with a sense of suffocation, pressure in the chest and perspiration. Several physicians had concurred in the diagnosis of true angina pectoris. Examination demonstrated a cervico-brachial neuralgia (pseudo-angina, page 194). Freezing of the sensitive paravertebral areas brought immediate relief and cure after six séances. At each successive séance, *new points of paravertebral tenderness developed and new areas in the distribution of pain* (the former paravertebral areas of tenderness and areas of pain having disappeared).

The areas were no doubt present at the primary examination but they were overwhelmed by the more intense areas elsewhere. This is in accordance with the

Law of Weber: Sensations increase as the logarithm of the stimuli. Thus, a candle light will increase the illumination in a dimly-lighted cellar, but the light would not be in evidence in the bright sunshine. This phenomenon from another view-point is in accordance with the physiologic dictum that "any center mediating a definite reflex suffers a loss in excitability whenever it is acted upon at the same time by any other pathway not concerned in that particular reflex."

PHRENIC NERVE.—Among the intrathoracic nerves this nerve may be implicated in a veritable neuralgia. The phrenic nerve is distributed to the pleura, pericardium and diaphragm, and after piercing the latter it supplies the capsule of the liver, spleen and gall-ducts. This nerve springs chiefly from the fourth cervical nerve, although it usually receives a twig from the third and fifth cervical nerves. Referring to Fig. 10, it will be noted that its chief source of origin corresponds to the fourth cervical segment. We note further, that its exit corresponds to the second and third cervical spines. In *pleurisy* and *pericarditis* I have almost invariably found points of tenderness corresponding to the latter spines, and by freezing the areas of tenderness, I have not only inhibited, but arrested the pains of these affections. In a diagnostic sense the maneuver is equally valuable, although one must reckon on possible implication of the capsule of the liver, spleen and gall-ducts, likewise innervated by this nerve.

In pleural pains, I have noted dermatomes connected with the fourth cervical segment (Figs. 23 and 24).

It is known that, when pain is associated with pulmonary disease, it is usually caused by pleural involvement.

In pneumonia and pleurisy, the chief pain is located in the abdomen. Here, the reflex pain is probably med-

iated by the phrenic nerve, which supplies the parietal peritoneum (page 416). In involvement of the structures innervated by the phrenic, *shoulder-pain* is not infrequent. The skin of the shoulder is supplied by the fourth and fifth cervical nerves, hence, the reflex distribution of pain (Fig. 22).

DIAPHRAGM REFLEX.—When intermittent pressure is made between the second and third cervical spines, a slight protuberance is noted on one or both sides in the epigastrium under the costal borders, with a wave running between the two protuberances. The maneuver is executed with the patient in the recumbent posture, knees flexed, head toward the window and at the end of expiration. The phenomenon is specified by the author as the diaphragm reflex. It is more constant than the phrenic shadow of Litten. It is absent in diseases of the phrenic nerves leading to spasm or paralysis of the diaphragm.

ANEURYSM OF THE AORTA.

DEFINITION.—An aneurysm signifies, literally, a dilatation, but there are nomenclators who insist in differentiating a dilatation from an aneurysm of the aorta. This, like many classifications of aneurysm, is essentially an anatomic and not a clinical question. Clinically, aortic dilatations may be divided into two groups, dilatations without (latent cases), and with symptoms.*

Prior to my recognition of the aortic reflexes, several of us saw a patient with pains radiating to the left arm and chest in whom the X-rays revealed simple aortic

*Even though an *aortic dilatation* is demonstrable, it is difficult to say what bearing it may have on the symptoms. The diagnostic-therapeutic test by daily concussion of the 7th cervical spine may be necessary for a decision. Within ten days, if aortectasis is related to the symptoms, the latter must show amelioration.

dilatation. The pains were sufficiently severe to demand analgesics, and yielded after three weeks rest in bed.

After three years, the pains recurred and the X-ray picture was identical with that of the first examination, yet several treatments of concussion to elicit the aortic reflex of contraction sufficed to subdue the symptoms.

Peripheral pains in the thorax and arms simulating neuritis without the symptoms of the latter (tenderness of the nerves in the implicated region, motor and sensory disturbances), suggest an aneurysm. The latter fact is illustrated in the case cited on page 575.

To escape the confusion created by a hybrid anatomico-clinical terminology, a compromise may be effected by employing the term *aortectasis*, to designate aneurysm or dilatation of the aorta. Aneurysm of the aorta is by no means as infrequent as is currently supposed; on the contrary, the percentage of deaths varies from 0.6 per cent. of total mortality (Emmerich) to 1.49 per cent. (Müller).

Death occurs suddenly, as a rule, owing to rupture of the sac, and many cases of sudden death referred to other conditions, owing to the absence of an autopsy, are often caused by an aneurysm.

Practically three-fourths of all aneurysms are aortic and nineteen-twentieths of these are located in the thoracic aorta. Of the latter, about 90 per cent. are saccular; from 80 to 90 per cent. occur in the male, and about 50 per cent. occur between the ages of 35 and 50.

Respecting the *etiology* of aneurysms, it has been said that the victim is usually one who has worshiped at the shrine of Venus, Bacchus or Vulcan. In etiology most writers ascribe the preponderating *rôle* to syphilis. The latter, as an etiologic factor varies in percentage from 25 (Klemperer) to 92 per cent. (Rasch). Indeed, Osler affirms that an aneurysm in a person of either sex, under the age of

thirty, is presumptive evidence of syphilis. Among my own patients (60), a syphilitic history was positively established in only 20 per cent. of the cases.

> In several instances, where a history of syphilis was positive, no Wassermann reaction was obtainable. Statistics show that in some of the late lesions of syphilis, a reaction may be elicited in only 50 per cent. of the cases. The reaction is usually positive in the secondary stage of untreated syphilis.
>
> Whether the reaction is positive or negative, mercurial inunctions are nevertheless indicated, although I have never observed any benefit from them in my aneurysmal cases.
>
> MESAORTITIS.—This is a peculiar type of arteriosclerosis associated with *aortic insufficiency* and *aneurysm*, and is comparatively frequent in syphilitics, notably in young subjects.
>
> A similar lesion is found in congenital syphilis. Spirochetes are demonstrable in the lesions.
>
> Evidence is accumulating to show that aortic insufficiency is one of the most frequent causes of syphilis, and a positive Wassermann reaction may be elicited in a number of patients thus afflicted.
>
> The *Babinski syndrome* (inequality of pupils and Argyll-Robertson phenomena with aneurysm), suggests syphilitic infection and so does the prompt relief afforded by potassium iodid, as suggested by Osler.

Among other factors contributory to the etiology are, overwork, traumatism, abuse of alcohol and the infectious diseases.

In the opinion of the writer, the foregoing factors may operate by diminishing vagus-tone. In accordance with this view-point, the anatomic changes in the aortic-wall may be secondary to the primary aortectasis. In young persons the most important etiologic factors are trauma and endo-

carditis, causing the so-called *embolomycotic aneurysms*. In the latter, bacteria are found in the aneurysmal wall similar to those found in endocardial vegetations.

SYMPTOMATOLOGY.—Since the advent of the X-rays and exact methods of percussion, the non-recognition of an aneurysm is an unpardonable error in diagnosis. The *subjective symptoms* are essentially pressure-symptoms and vary with the degree and location of the dilatation.

Among the symptoms may be mentioned:

1. Pain in the sternum, ribs or the spine from direct pressure; surrounding the upper-chest, from pressure on the intercostal nerves; radiating down the side of the chest and the inner surface of the arm, from pressure on fibers distributed by the intercosto-humeral nerve.

2. *Dyspnea.*—Caused by irritation of the recurrent nerve (aphonia, hoarseness and a metallic cough), tracheal, bronchial or pulmonary pressure. Dyspnea may be paroxysmal and suggests asthma.

3. *Cough.*—A frequent early sign, of a peculiar wheezy, brazen or metallic character ("goose-cough"). Cough is caused by pressure on the vagus, recurrent laryngeal nerve, compression of the trachea or a main bronchus. Pressure on either of the two latter structures is associated with stridor and expectoration. Cough and dyspnea are out of proportion to the physical signs. The symptoms may suggest phthisis (*aneurysmal phthisis*).

4. *Dysphagia.*—Caused by spasm or stenosis of the esophagus.

5. *Hemorrhage.*—Caused by tracheal granulations at the point of compression, rupture into the bronchial tree or from erosion or perforation of the lung. Bleeding may be sudden, profuse and fatal, or recurrent for months.

6. *Emaciation.*—From pressure on the thoracic duct.

The author wishes to emphasize the fact that the symptoms are often paroxysmal, for the reason that the aorta is not constant in caliber; a temporary increase of dilatation may precipitate a group of symptoms which disappear when the lumen of the vessel is restored.

Fig. 122 shows the relation of the aorta to adjacent structures and is explanatory of aneurysmal symptomatology.

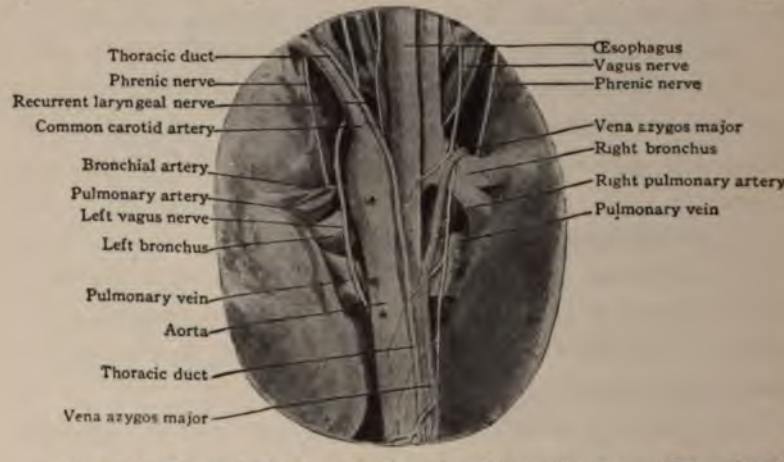


FIG. 122.—Contents of the mediastina viewed from the rear. (From Davis, applied Anatomy, J. B. Lippincott Co., publishers).

OBJECTIVE SYMPTOMS.—1. *Percussion shock.*—Direct percussion over an aneurysmal area elicits a shock not unlike that felt when a rubber-bag filled with water is simultaneously palpated and percussed (semi-fluctuation). This sign, original with Smith, was detected in 62 per cent. of his cases, whereas the tug, to be described presently, was present in only 46 per cent. of his cases. Grasping the cricoid cartilage for eliciting the following sign (tugging) while an assistant percusses the chest, a direct and resilient shock is felt when an aneurysmal area is reached. Normal chest-areas reveal to the fingers at the cricoid cartilage only a distant feeble jar.

2. *Tracheal tug.*—This sign of Oliver is as follows: With patient standing with closed mouth and elevated chin, grasp cricoid cartilage between finger and thumb and lift it. A tug, most marked in inspiration and transmitted to the fingers, is supposed to be diagnostic of aortectasis. The latter is not correct, insomuch as it is found in conditions which cause adhesions between the aorta and air-passages. It is not infrequent in tuberculosis, pleuritis, mediastinal tumors, enlarged bronchial glands and in enteroptosis, when the heart descends with the liver, and the arch of the aorta in this way makes traction upon the bronchi. *The author finds that this symptom is best elicited at the end of a forced inspiration.*

3. *Inspection.*—Dilatation of the veins of the neck, chest and arms. Diffused arterial pulsations of the carotids and subclavians. Pulsation in the first and second interspaces. To detect latter, patient must be in recumbent posture in a good light and the observer's eyes should be on a level with the chest, which must be viewed in different directions. Inspection of the patient's back for pulsations is equally important. Swelling and edema of the right arm may be present from pressure on the subclavian vein and, on the front of the chest, from pressure on the internal mammary, azygos or hemiazygos veins. The larynx may be pulled downward and displaced to one side.

4. *Palpation.*—In some cases, the aorta can be palpated in the episternal notch and a lift of the manubrium can be felt. Over the dilatation, one may feel a diastolic shock or a systolic thrill or both. Differences in the radial pulse are so frequent, even in the norm, that little importance can be attached to changes in the radial pulse on both sides.

The author wishes to direct attention to a new sign in

thoracic aneurysms, viz., extreme sensitiveness of the vagus to palpation on one or the other side of the neck.

As a rule, the most tender points are located where the recurrent laryngeal nerve enters the larynx behind the articulation of the inferior cornu of the thyroid cartilage with the cricoid, and at a point between the hyoid bone and the ala of the thyroid cartilage, where the internal branch of the superior laryngeal nerve pierces the thyrohyoid membrane. The latter is the sensory nerve for the interior of the larynx and trachea.

An absence of pulsation in the femoral arteries may be noted in abdominal aneurysms, due to the fact, as Osler suggests, that the sac acts as a reservoir, annihilating the ventricular systole, thus converting the intermittent into a continuous stream.

5. *Auscultation.*—Accentuation of the second aortic tone, a systolic murmur and a diastolic murmur, if aortic insufficiency accompanies the aortic dilatation. An accentuated metallic second sound over the sac of the aneurysm. An important sign is either the disappearance or modification of the murmur, if present, after concussion-treatment of the seventh cervical spine (page 525).

Drummond refers to a systolic murmur heard in the trachea or at the open mouth of the patient. Respiration may be feeble or absent in some part of the lung, owing to pressure of the dilated aorta (*vide* report of case on page 575).

6. *Percussion.*—This is one of the most important signs if executed according to the methods suggested by the author. Percussion should be made during the time the chest in in the position of *forced expiration.* A number of measurements made by the author show that, during the latter phase of respiration, the sagittal diameter of the chest approximates the arch of the aorta from .3 to 1.6 cm. After

this manner, the elicitation of substernal dulness is facilitated (page 254). Vibrosuppression (page 80) may be required. The author now finds that the elicitation of the aortic reflex of dilatation (page 255) is no longer necessary when the arch is to be delimited. Here, the aim was to accentuate dulness of the aorta by increasing its caliber. Either of the two following methods, preferably the first, may be employed.

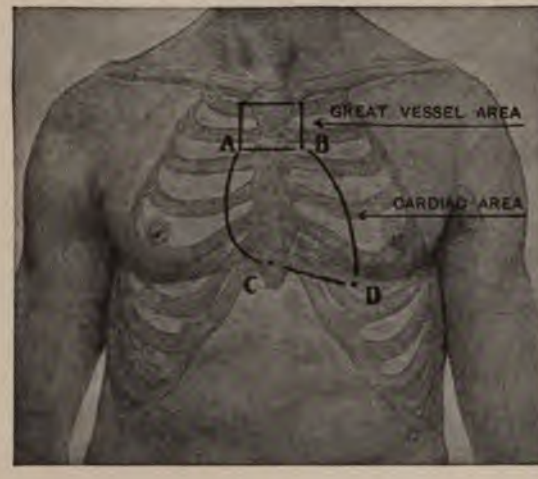


FIG. 123.—Normal boundaries of the heart and great vessels. The nipples in this figure are too far away from the median line(Butler's Diagnostics of Internal Medicine).

The SUPRACARDIAC VASCULAR AREA containing the aorta and pulmonary artery, may be represented by drawing a horizontal line across the base of the heart ($\frac{3}{4}$ inch below the upper border of the manubrium, the so-called episternal notch), and two vertical lines extending on either side of the sternum, from the base of the heart to about the lower border of the 1st rib.

The ASCENDING AORTA lies behind the sternum between the third left chrondrosternal junction and the second right costal or aortic cartilage. The latter point

represents the commencement of the AORTIC ARCH, which runs obliquely upward and backward toward the 4th dorsal vertebra, where it continues as the descending thoracic aorta.

The highest point of the aortic arch in the median line is at about the center of the manubrium (about 1 inch or 2.5 cm. below the episternal notch).

The PULMONARY ARTERY traverses the left sternal border under the 2nd intercostal space and the 2nd costal cartilage.

The arch of the aorta terminates at a point in the back to the left of the third dorsal vertebra, at which point the bifurcation of the trachea occurs.

VAGUS-TONE METHOD.—The aortic tone is under the influence of the vagus, and when the latter is increased, percussion of the thoracic aorta is abetted. During percussion, pressure may be made at the 7th cervical spine by an assistant, or, better still, the head of the patient is placed in a position of forcible extension (page 228).

I must again emphasize the importance of *palpatory percussion*, *i. e.*, to determine dulness by the sense of resistance. In other words, to disregard the audible quality of the percussion-sound.

Direct percussion of the vertebral spines (3d to 6th dorsal spines) may reveal the dulness of an aneurysm (*vide*, vertebral concussion, page 79).

Fig. 124 shows the normal percussion-zones of the spine.

POSTURAL METHOD.—When the patient stands on an elevation (Fig. 125), and stoops far forward, the course of the aortic arch may be easily defined by percussion. In both methods, forcible percussion must be used. The measurements of the aorta in the norm have been described on page 255.

The fact that, a supposititious area of dulness due to an

aneurysm may be diminished or increased in area by the elicitation of the aortic reflexes, may be utilized in diagnosis.

DAM-SIGN.—By this new phenomenon, I refer to an increase in the area of aneurysmal dulness (of the thoracic or abdominal aorta), when the legs are forcibly flexed on the thighs and the latter on the abdomen. Compression of the abdominal aorta or an india rubber tube applied after the

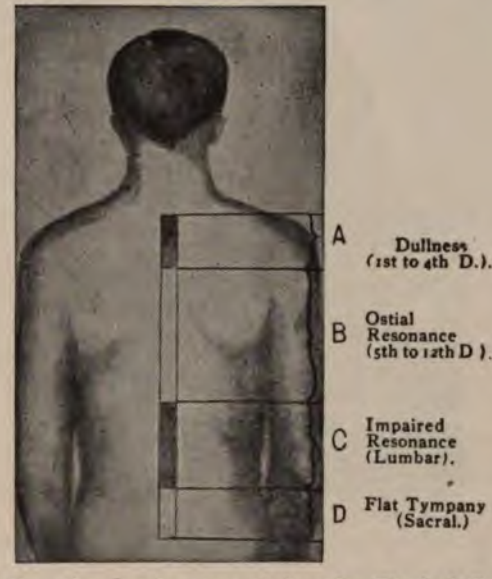


FIG. 124.—Normal percussion-zones of the spine (Korányi, Da Costa).

method of Momburg for hemostasis will yield the same result. By any of the preceding maneuvers, the blood is increased in quantity in the aneurysmal sac and distends it.

Aside from the latter maneuvers and the aortic reflexes, the area of aneurysmal dulness is diminished when the skin corresponding to the latter is irritated or when the tone of the vagus is increased by the method shown in Fig. 65.

During the period of forced inspiration the diameter of

an aneurysm is increased and decreased during a forced expiration. During the former, the intrathoracic blood-vessels are filled, and during expiration, they are relatively empty (aspiration action of the thorax).

FIG. 125.—Illustrating the postural method of determining the course of the thoracic aorta by percussion.

AUSCULTATORY PERCUSSION.—Percussion of aneurysms, as well as the solid viscera, may be facilitated by two methods of the author described elsewhere[98] in detail:

1. If, during percussion, a stethoscope is allowed to hang from the ears of the physician (no part of the instrument being in contact with the chest of the patient), nuances in the percussion-sound, unrecognizable by unassisted audition, are demonstrable. Here the stethoscope is employed as a microphone.

2. By employing the principle of transsonance. With the finger, strike directly the 7th cervical spine, and while so doing, gradually approach the site of aneurysmal dulness. When the outer boundary of the latter is attained, the transmitted resonance is no longer in evidence.

FIG. 126.—Right anterior oblique position. A, clear area, corresponding to right lung; B, shadow of vertebral column; C, clear middle space; D, shadow of normal heart and aorta; E, clear area corresponding to left lung. ——, dilated aorta; ...., small commencing aneurysm, —.—.—, upper part, larger aneurysm; —.—.—, lower part, position of dilated auricle.

7. FLUOROSCOPY OF THE AORTA.—Radio-diagnosis may be achieved by fluoroscopy and skiagraphy. In the former method, which we will alone consider, the aorta traversed by the rays is directly examined by the fluorescent screen. With a large screen covered with glass the aorta may be outlined on the latter by means of a pencil, such as is used in writing on glass. In the early history of radio-diagnosis, thoracic aneurysms were diagnosed more frequently than in the present state of our advanced knowledge. Thus, Sailer and Pfahler, have demonstrated that tortuosity of the aorta

in arteriosclerosis strongly suggests aneurysm on fluoroscopic examination. Many errors are now obviated by an X-ray examination in the *right anterior oblique position;* the rays are made to penetrate the chest obliquely at an angle of 45 degrees from behind forward and from left to right; the screen is in front and to the right and the tube behind and to the left. In this position, the aortic shadow with parallel sides is observed throughout its entire length, and terminates in a rounded extremity at a point corresponding to the level of the sterno-clavicular articulations and the third dorsal vertebra. The picture presented in this position is illustrated (Fig. 126) after Holzknecht.

Reference must also be made to the accompanying illustration (Fig. 127). No. 1 illustrates the normal aorta in the antero-posterior examination; the parallel lines show the central opacity, and the part shaded, the aorta, which extends to one side of the central opacity. In No. 2 an examination of the normal aorta, conducted in the right anterior oblique position, shows the vertebral shadow, represented by the parallel lines, and the shaded part, the aorta. No. 3 is the aorta examined in the ordinary antero-posterior position, and the supposition would be that an aneurysmal sac is present, but if the patient assumes the right anterior oblique position, the sac is no longer evident (No. 4), but the aortic shadow is broader and retains its parallel borders, hence aortic dilatation and not aneurysm exists. Nos. 5 and 6 illustrate an aneurysm, and 7 and 8 a small aneurysm arising from the under surface of the arch. Note that in Nos. 7 and 8 there is nothing in the pictures to indicate that an aneurysm exists; in fact, the appearance differs in no wise from the normal (Nos. 1 and 2). In all examinations for a suspected aneurysm the tube should be placed in all positions.

The shadow of an aneurysm is more pronounced, the greater the amount of organized clot. If the shadow is situated to the right of the central opacity and nearer the front than the back of the chest, the ascending aorta is involved; but if the shadow is projected to the left and nearer

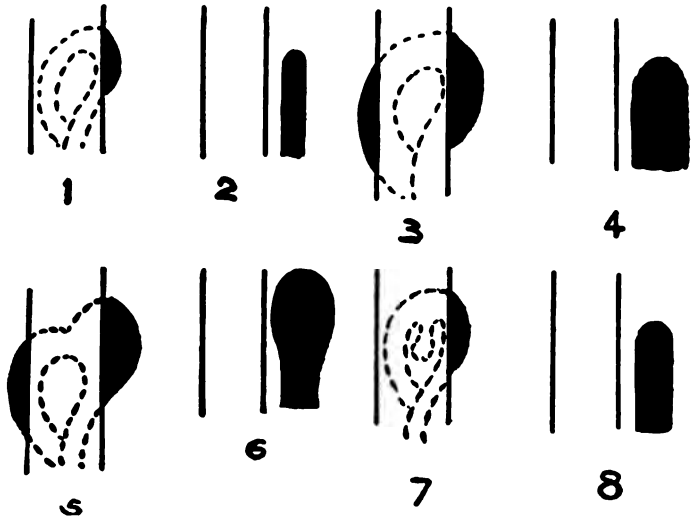


FIG. 127.—Radioscopic examination of the aorta, after Holzknecht (*vide* description in the text).

the back than the front, the descending aorta is probably involved. The depth of the aneurysmal sac from the surface may be approximately determined on the principle that the nearer the sac is to the surface, the more defined will be the outlines and the less intensified the shadow. Hence, in rotating the patient and examining the shadow anteriorly and posteriorly, it is presumably nearer that surface where

the shadow is the smaller and more clearly defined. The course of the aneurysm during treatment may be followed if at the primary examination a record is made by means of the orthodiagraph. Pulsations of a shadow argue for an aneurysm, but the latter does not always show pulsation; in fact, a dilated aorta may show more forcible pulsations than an aneurysm. When pulsations are absent, the inhalation of amyl nitrite, as I have frequently demonstrated, will bring them into existence. Neoplasms may show a communicated pulsation from the heart or the blood-vessels.

In the usual examination with the tube in the center behind the patient, one observes only the bend of the aorta projecting to the left of the sternum beneath the clavicle, whereas the ascending and descending portions cannot be seen. In dilatation of the aorta, the shadow extends either to the right or left of the sternum or both, and it persists between pulsations. In neurotic individuals and when the aorta is dislocated (a condition which I shall call *aortoptosis*) in enteroptosis, a shadow extending beyond the sternum may suggest aneurysm, but as a rule, between pulsations, the shadow recedes behind the sternum. In aneurysms of the *innominate*, there is a clear space (with a narrow shadow of the artery) between the latter and the aortic shadow.

In differentiating the shadows of structures (glands, tumors, etc.) from aneurysms, the former may rotate upon their axes, but they do not show the expansion of aneurysms during systole and their contraction during diastole. An invaluable aid is furnished by the elicitation of the aortic reflexes during the fluoroscopic examination (*vide* report of case on page 575).

I have found that an aneurysm, like the heart, responds by contracting when the skin over the aneurysm is irritated,

hence cutaneous irritation is of no value in differentiating the silhouette of the heart from an aneurysm.

Among other signs of thoracic aneurysm may be mentioned: inequality of the pupils (anisocoria) due to pressure upon the sympathetic or alterations in the circulation, delay and inequality of the radial pulses, pain and persistent numbness in the shoulder and arm, signs of arteriosclerosis (thickening of the palpable arteries) and abatement of symptoms after a single séance of concussion applied to the seventh cervical spine.

FIG. 128.—Percussion-areas of an aneurysm of the abdominal aorta seen in consultation with Dr. Visscher. A, area of aneurysmal dullness by percussion; B and C, aorta reflexes of dilatation and contraction. Reduced. Compare with Fig. 72.

Broncho-esophagoscopy may show tracheal compression and pulsation or a pulsatile tumor implicating the esophageal wall.

ANEURYSM OF THE PULMONARY ARTERY.—Aneurysms of this vessel are comparatively very rare. The symptoms (dyspnea, cyanosis, cough, bloody expectoration, murmur n second left inter-space, etc.) may suggest congenital heart

disease. An X-ray examination furnishes the most trustworthy evidence, although the affection is rarely interpreted *intra vitam*.

ANEURYSM OF THE ABDOMINAL AORTA.—This is relatively frequent (10–14 per cent. of aneurysms), and trauma plays an important *rôle* in etiology. The aneurysmal sac is located most often just below the diaphragm in juxtaposition to the celiac axis.

FIG. 129.—Apparatus for taking tracings of the abdominal aorta. The pulsations are conveyed by a cardiograph to a registering tambour.

The *subjective signs* are: neuralgic abdominal pains radiating in every possible direction and suggesting renal calculi, gastric ulcer and other affections.

The *objective signs* are: expansile pulsation of an epigastric tumor, over which a thrill may be felt or a systolic murmur may be heard, retardation and inequality of the femoral pulses, an area of dulness influenced by the aortic reflexes (Figs. 72, 73 and 128) and an X-ray examination. The latter may be made with the fluoroscope after the patient has been freely purged for several days and limited to a diet of milk. Inflation of the colon with air and the use of a "compression-diaphragm" aid the fluoroscopic diagnosis.

It is the usual practice of the author to make tracings of the abdominal aorta (*aortograms*) as aids in diagnosis. They are made with the same ease as sphygmograms of the radial artery. The patient is placed in the recumbent posture, and, at the end of a forced expiration, during the time breathing is suspended, the cardiograph is placed over the abdominal aorta. The apparatus is shown in Fig. 129.

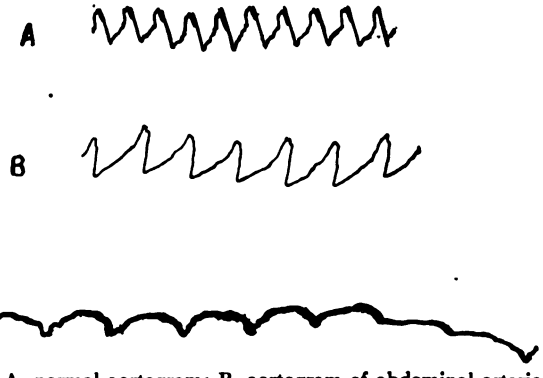


FIG. 130.—A, normal aortogram; B, aortogram of abdominal arteriosclerosis; C, aortogram of an aneurysm of the abdominal aorta (Fig. 128)

The course of the *abdominal aorta* is determined by a line (aortic line) drawn from the ensiform cartilage (to the left of the linea alba) to the level of the highest part of the iliac crest. At the latter point ($\frac{3}{4}$ inch below the navel), the aorta divides into the two common iliac arteries.

The CELIAC AXIS is located on the aortic line about 4 or 5 inches (10 or 12.5 cm.) above the navel.

On the back, the aortic orifice in the diaphragm corresponds to the 12th dorsal vertebra, and the celiac axis to the lower border of this vertebra.

ABDOMINAL ARTERIOSCLEROSIS.—Paroxysmal pains due to this affection are diagnosed with difficulty by the conventional methods (page 266). Here, pathognomonic aortograms may be taken.

I have noted that when the cardiograph compressed the abdominal aorta, some of the abdominal arteriosclerotics suffered from their characteristic pains.

What I did by the latter maneuver was to produce an ischemia, thus accounting for the phenomenon of claudication (page 226). Compression of the abdominal aorta to obliteration with the fingers may therefore be utilized as a new objective sign of abdominal arteriosclerosis.

In enteroptosis with loose peritoneal moorings of the aorta (aortoptosis), in neurasthenic women and in arteriosclerosis of the abdominal aorta, a "*throbbing aorta*" may suggest aneurysm of the vessel. Here, there is no definite tumor and no expansile pulsation. Tumors in the abdomen may show a communicated aortic pulsation, but the latter usually disappears in the knee-elbow position.

TREATMENT OF ANEURYSMS.

Nothing can be added to the method of cure suggested on page 257 *et seq.*

The author has reported in *The British Medical Journal* (July 8, 1911), and in *La Presse Médicale* (Oct. 4, 1911), forty cases in his own practice of thoracic and abdominal aneurysms which were symptomatically cured within a few weeks by the concussion-treatment with absolutely no other adjuvant measures (not even rest).

Since then, seven other cases were treated with the same results.

The cases were all advanced and there was absolutely no break in the continuity of successful results.

Some of the author's cases were seen after four years with absolutely no recurrence of symptoms.

It is only just that I should advert to several patients in whom minor symptoms (a slight cough, dyspnea on exertion

and an inability to assume the recumbent posture) persisted.

"Nothing ever gets quite well." The author's treatment of aneurysm does not and cannot eliminate the aneurysmal sac, although it is somewhat reduced in dimensions.

It is impossible to conceive of a large intrathoracic intumescence without some mechanic disturbances incident thereto.

For the latter reason, the author advisedly refers to his results as "symptomatic cures."

Failures by others to elicit results could always be attributed to mistreatment (page 473).

The incurability of aortic aneurysms has been for eons such an *idée fixe*, that it has graduated into an obsession.

Probably the most brilliant achievement of Spondylotherapy consists in the diagnosis and cure of *aortic aneurysms*. Most men will agree that the cure of aneurysms should be considered one of the greatest contributions ever made to scientific medicine. But such is the cautiousness of medical minds that few reviewers of Spondylotherapy have had the faith or the courage to speak of this, its greatest achievement. Yet, nothing in medicine is now more completely proven, and nothing can be more easily demonstrated, than that Spondylotherapy can and does cure this heretofore incurable disease.

The treatment in question is practically a specific. I have the reports of 12 cases (in addition to my own), from other physicians whose results practically tally with my own, despite the fact that only primitive apparatus was employed in the elicitation of the aortic reflex of contraction. The following case, reported [99] by Dr. L. St. John Hely, of Madera, California, is cited for the following reasons: the disease was

very advanced, the relief was practically immediate and the primitive method shown in Fig. 2 was used.

This same patient was seen after eighteen months about whom Dr. Hely reports as follows:

"I am enclosing you three photographs of the patient John Artmann, whose case was treated 18 months ago. He came into my office yesterday and his condition is absolutely normal. It was so wonderful that I got out my camera and made these pictures. There are no pulsations, nor feelings of pulsations at all in the tumor and holding the hand on the tumor after climbing the stairs conveys no suggestion whatever of pulsations. Facies normal."

Dr. Hely, reported another case with "the same brilliant results."

Report of Dr. Hely:

"The writer presents the following history of a patient suffering from aneurysm of the thoracic aorta who was treated by the 'concussion-method' of Abrams:

"J. A., age 46 years; weight, 185 pounds; a blacksmith and a moderate drinker; had no previous history of illness beyond the diseases of childhood. On the sixth of November, 1909, the patient first noticed a small projection in the region of the first rib about the size of a dime. A peculiar burning sensation corresponding to the latter point was likewise noted, but the patient gave it no serious consideration until December 19 of that year, when while assisting in lifting a wagon he experienced a choking feeling and the miniature projection attained an enormous size. The patient then sought medical counsel and the diagnosis of a thoracic aneurysm was definitely established. At this time the following subjective and objective symptoms were noted:

"Pronounced cyanosis which was universal, cardiac palpitation, choking, and dyspnea upon the slightest exertion, and an almost incessant cough. At night the patient could find a modicum of relief only in one posi-

tion, viz., propped at an angle of 45° on the right side, and even then the coughing and choking would awaken him every hour. I regarded his condition as absolutely hopeless and so informed his friends. Having at this time read of the method of Abrams, I employed it first on January 21, 1910. Concussion treatment of the seventh cervical vertebral spine was executed daily for

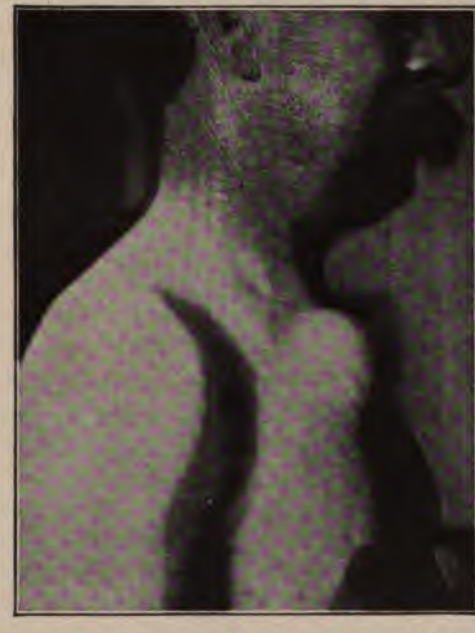


FIG. 131.—Showing external tumor in Dr. L. St. John Hely's case of aneurysm of the thoracic aorta.

fifteen minutes from the latter date until March 5, 1910, when treatment was discontinued.

"The second night following the concussion the patient rested well, and after the fourth treatment there was an absolute evanescence of all symptoms. In the language of the patient, "I can now sleep in any position and like a baby; in fact, as natural as any one. I do not cough nor suffocate any more, and, aside from the tumor on the

chest, I would not know that there was anything at all the matter with me."

"The aneurysmal tumor when first examined projected considerably and measured about 2½ inches in diameter at the base. At the end of the first week's treatment the tumor was reduced about 25 per cent, but there was no apparent further diminution in size when treatment was discontinued. It was impossible for me to continue treatment, as the patient insisted that he was well and further treatment was unnecessary. The results in this case were, however, immediate and corresponded in the main with the results obtained in the cases reported by Dr. Abrams."

Two other reported cures were made by Dr. L. C. Boyd of Long Beach (*New York Medical Journal*, Oct. 21, 1911) and Dr. M. L. Turnbull, of San Francisco (*Medical Record*, Sept. 9, 1911).

Dr. L. C. Boyd reports as follows:

"In the *British Medical Journal* (July 8, 1911), Dr. Albert Abrams, of San Francisco, reports forty cases of aneurysm of the thoracic and abdominal aorta treated by his method of concussion of the seventh cervical spine. His method is practically a specific in a disease which has heretofore baffled our best efforts, and it creates an epoch in therapeutic medicine and elevates physiologic therapeutics to a place of distinction in the armamentarium of the physician.

"Mrs. H., age, 31. Duration of symptoms, three years.

"SUBJECTIVE SYMPTOMS.—Precordial pain, radiating to head and left arm. The painful paroxysms were accompanied by great prostration. Dyspnea was constant and like the pain was accentuated by exertion, emotions or high altitude.

"There was a troublesome dysphagia, insomnia and dysphonia.

"OBJECTIVE SYMPTOMS.—Moderate exophthalmos,

vascular engorgement of face, neck and hands (notably on the left side).

"The right radial pulse was retarded and weakened.

"There was a slight bulging of the anterior chest-wall corresponding to the first and second intercostal spaces on the left side and a marked area of dulness on percussion.

"The latter dulness could be made to contract or enlarge in area at will by elicitation of the aortic reflexes. (This is an important diagnostic aid in differentiating the dulness of aneurysms from the dulness of other causes.)

"Palpation yielded a slight systolic thrill over the area of aneurysmal dulness.

"A loud systolic bruit was heard over the aneurysmal dulness which was propagated posteriorly along the course of the descending aorta.

"There was an accentuated second aortic tone.

"The heart was somewhat displaced to the left and the apex beat was diffused over a large area and diminished in force.

"Slight tracheal tugging was present.

"Treatment was administered twice daily and commenced on July 2, 1911, and continued until the 17th of the same month.

"The following notes are based on an examination made on Aug. 8, 1911.

"SUBJECTIVE SYMPTOMS.—Absolutely no pains of any kind. Dyspnea, dysphagia and insomnia have disappeared. The voice is practically restored and the patient expresses herself as being highly gratified with the *complete relief* from previous agonizing physical suffering which this treatment has afforded.

"OBJECTIVE SYMPTOMS.—No exophthalmos nor vascular engorgement of the head and extremities.

"Right radial pulse no longer retarded and restored to the norm.

"The bulging of the anterior chest-wall is still present, but diminished.

"The former aneurysmal area of dulness is fairly resonant but not completely so. The latter may be attributed to the induration of the chest-wall contiguous to the site of the aneurysm.

"There is no longer any accentuation of the second aortic tone.

"The systolic thrill and bruit have disappeared.

"The apex beat is not diffused but circumscribed and has regained its normal position.

"Tracheal tugging persists.

"Improvement in strength and general appearance of well-being still continues.

"There was no X-ray verification of the conditions in this case, but the physical signs respecting the aneurysm and the results of treatment were absolutely positive and unmistakable."

Dr. M. L. Turnbull, presents the following:

"The report of the following patient, I believe to be indicated, for the reason that we have heretofore regarded aneurysms of the aorta among the incurable diseases.

"A. D., age, 28 years. Sent to California by his physicians in Chicago for supposed pulmonary tuberculosis.

"Seven years ago contracted syphilis. Entered the service of Dr. W. C. Voorsanger, at the Mount Zion Hospital, for dyspnea, pains in the chest and a constant cough and expectoration which permitted him no sleep at night without the use of narcotics. Slight dysphonia. Veins of the neck very prominent and dilated. Slight tracheal tugging.

"Pronounced dulness on percussion of the upper chest corresponding to the arch of the aorta, which measures 6 cm. in diameter.

"Systolic murmur over aorta propagated toward the left shoulder.

"Palpation reveals a diastolic shock over the region corresponding to the orifice of the pulmonary artery.

"A skiagraph shows an immense aneurysm of the thoracic aorta, chiefly implicating the arch.

"Examination of the sputa, negative.

"A vigorous course of inunctions was without effect on the symptoms.

"At this time the patient presented an anemic appearance and his weight was 118 pounds.

"Treatment by concussion daily of the 7th cervical spine was commenced on April 26, 1911. After the first séance of concussion, lasting ten minutes, the systolic murmur over the aorta almost disappeared.

"On April 29, the aneurysmal dulness measures transversely 2.6 cm.

"May 1, 1911, aneurysm measures 2 cm. and the patient's weight is 123 pounds.

"May 3, 1911, absolutely no dulness over site of aneurysm, pains in chest gone, expectoration reduced about 50 per cent, but cough continues with less frequency and severity.

"July 1, 1911. Patient's weight is now 135 pounds. Has absolutely no symptom beyond an occasional cough, which may be attributed to a naso-pharyngeal catarrh."

COMMENTS BY THE AUTHOR.—On Nov. 28, 1911, this patient developed a violent cough followed by hemoptysis. His aneurysmal symptoms were absolutely gone, and for this reason search was made for his trouble. An apical infiltration was demonstrated with a large number of tubercle bacilli in his sputum. Previous examinations of his lungs and sputa were negative.

The following anamnesis is extremely interesting in illustrating discordant views among the leading medical authorities, coupled with the fact that, the execution of a simple diagnostic sign would have clarified a bizarre and protean clinical picture:

A prominent attorney suffered for several months in San Francisco from periodic paroxysms of coughing, which were so violent as to induce attacks of vertigo, and narcotics were administered to subdue them. His

physicians were unable to trace the genesis of the cough, and receiving no relief, he left for Europe for further counsel. During his sojourn in Europe, he suffered from atrocious pains in the chest and the left arm. Some ascribed the pains to *neuritis*, although there was absolutely no objective evidence of the latter. Repeated skiagrams of the chest demonstrated the presence of an intrathoracic shadow (Fig. 132), the nature of which was variously interpreted. Kocher, of Bern, after deliberating a week concerning his findings concluded that, the patient was the victim of a spinal growth and that a serious and immediate operation was necessary.

FIG. 132.—Intrathoracic shadow of an aneurysm interpreted as a spinal growth (*vide* text).

The patient almost concluded to submit to an operation, but before so doing, he consulted Sahli of Bern. The latter assured him that he could find no growth and prescribed *quinin*, which caused the pains (which had previously resisted narcotics) to evanesce.

The patient was subsequently examined by at least twelve of the leading authorities of Europe, all of whom gave varying opinions. On the return of the patient to this city, the paroxysms of cough continued with unabated severity.

My examination in brief, revealed the following:

1. Dilatation of the arch of the aorta on percussion;

2. Slight tracheal tugging;
3. Induration and inflamation of the vocal cords and a slight arytenoid paralysis;
4. Absence of respiratory sounds over the lower lobe of the right lung;
5. On fluoroscopic examination, a shadow was seen, which was somewhat fusiform in contour and approximated the spine.

COMMENTS BY THE AUTHOR.—The possession of an X-ray apparatus does no more in postulating a knowledge of skiascopy than the possession of a microscope of microscopy The errors perpetrated by the microscopist are no less grave than those of the skiascopist. The proper interpretation of an X-ray examination, coupled with correct technic, means essentially a study of chiaroscuro, or of light and shadow effects. An X-ray examination is practically an autopsy conducted on the living and misinterpretation may make a verity of a metaphor. If the *aortic reflexes* had been elicited during the fluoroscopic examination, an error in diagnosis would have been practically impossible, insomuch as the contraction and dilatation of the shadow would have demonstrated its association with the aorta.

The fact that, the respiratory sounds over the lower lobe of the right lung were again audible after a brief séance of concussion of the seventh cervical spine, was in itself a demonstration that, the treatment contracted a dilated aorta and thus temporarily eliminated a mechanic bronchostenosis which accounted for the absent vesicular murmur.

The paroxysmal symptoms of the patient suggested an aneurysm, insomuch as we know that the lumen of the aorta is not constant and is subjected to periodic fluctuations from a variety of causes (page 620).

The fact that the pains were primarily relieved by quinin,

only emphasizes the importance of this medicament in increasing vagus-tone and thus diminishing the caliber of the aorta which by pressure caused the pains from which the patient suffered. Two weeks daily concussion of the seventh cervical spine practically subdued the violent paroxysms of coughing and the larynx was almost restored to normal.

The author finds that fusiform aortic dilatations are less amenable to rapid results from concussion than are the saccular dilatations.

Dr. W. T. Baird, a prominent physician of El Paso, Texas, presents the following autobiography of his case (reported in the *Medical Record*):

> ANEURYSM OF THE INNOMINATE ARTERY.—"Dr. W. T. Baird. Age, almost 80 years. Practiced medicine continuously for 47 years, during 8 years of which time I was A. A. Surgeon in the U. S. army. Had la grippe in 1888, and since this time have suffered from cardiac arrhythmia. During the last 5 years I have experienced almost constant coldness and numbness in my left leg. About one year ago, pains of a peculiar sickening and prostrating character were experienced in the arms and chest and they would awaken me at night. About three months ago, I felt a pressure on my trachea which affected my voice to the extent of aphonia. Since about one year, I first observed a diffused pulsation in the supra-sternal fossa. My pains increasing in severity and dyspnea becoming accentuated, I was examined by Drs. Gallagher, Brown, Calnan and Fleming, of El Paso, all of whom concurred in the diagnosis of an aneurysm. I then decided to go to Dr. Albert Abrams, of San Francisco, for treatment. I certainly supposed that a physician who had originated a new method of treatment for an incurable disease was best qualified to treat it.
>
> "After my very first treatment, a troublesome and persistent cough has never returned. At the commence-

ment of treatment, my voice, which was then only a 'squeak,' was rapidly restored to normal.

"After twelve treatments, I observed the following relative to my condition: cardiac arrhythmia has disappeared, coldness and numbness in my left leg are no longer present and the pressure on my trachea and the air-hunger have disappeared. In fact, I regard myself as perfectly restored. At about the end of a week, the supra-sternal pulsation was fully reduced 50 per cent."

COMMENTS BY THE AUTHOR.—My examination revealed dilatation of the aorta, but the arteria innominata was chiefly implicated in the angiectasis.

Painful and deformed fingers due to *arthritis deformans* were almost restored to normal after twelve treatments.

The results thus attained are given explanation on page 402.

The disappearance of arrhythmia and other circulatory disturbances, can be attributed to myocardial-toning, insomuch as the method of treatment (concussion of the 7th cervical spine), evoked equally the heart and aortic reflexes of contraction.

Pains in the arms from which Dr. Baird has suffered for years were caused by an osteo-arthritis of the shoulder joints. An ankylosis of the shoulder is not uncommon and the adhesions are concealed by the compensatory movement of the scapula. Any elevation of the arm beyond the horizontal in the norm is effected by rotation of the scapula, hence, in testing the joint fix the scapula. Aside from restricted and painful motion in the joint, I have found that the sensitive points in the course of the brachial plexus, are made more sensitive by active and passive movements. In inflammation of joints limitation of motion is also due to rigid muscles, in conformity with the law of Hilton:—nerves innervating groups of muscles moving a joint also furnish a distribution of nerves to the skin over the insertions of the same muscles, and the interior of the joint receives its nerves from the same source.

Even an imperceptible ankylosis may show acute exacer-

bations suggesting neuritis, but the absence of definite areas of tenderness in the course of the radiating pains excludes neuritis. Here, large doses of the salicylates (page 142) are effective.

> Dr. Baird noted attacks of intense dyspnea after riding in his automobile. After riding in larger machines such attacks did not ensue. The back of his seat corresponded to the third dorsal spine, which, when concussed enlarges the large intrathoracic blood-vessels
>
> ANEURYSM OF THE THORACIC AND ABDOMINAL AORTA IN THE SAME SUBJECT.—A gentlemen, 43 years of age, sought relief for attacks of pain in the chest and abdomen. Intense dyspnea at night and coughing prevented sleep. Lost 50 pounds in weight. Examination revealed in brief an aneurysm of the thoracic and abdominal aorta. When the patient first came under observation a chronic parenchymatous nephritis was demonstrated and the symptoms (edema, dyspnea) becoming accentuated, further treatment of the aneurysms was suspended.

If percussion of the thoracic aorta, were executed as a routine method of examination, a clinical in lieu of an anatomical diagonosis would be more frequent and many apparently trivial symptoms could be traced to their real source of origin.

Recently, the author examined an individual whose *only* symptom was an incessant desire to swallow, for which no relief was obtained. Examination demonstrated an aneurysm of the thoracic aorta.

The non-recognition of an aneurysm is an unpardonable error in diagnosis, and the modernist can no longer seek refuge for his dereliction in the traditional classification: (*a*) Aneurysms with signs and symptoms. (*b*) Aneurysms with symptoms but no signs. (*c*) Aneurysms with neither symptoms nor signs.

Rationale of the Author's Method

RATIONALE OF THE AUTHOR'S METHOD.—This is essentially the employment of a reflex in treatment* (page 392). The author believes that the cure of aneurysm by his method is achieved by increasing the contractility and tonicity of the aorta (page 410) and that the impulses are conveyed indirectly to the vagus (page 519 and Fig. 119).

Reduction in the area of an aneurysm as demonstrated by numerous skiagrams is never in proportion to the amelioration of the subjective symptoms.

Percussion may show an absence of aneurysmal dulness in patients symptomatically cured, yet a skiagram reveals the aneurysm but only slightly diminished in area.

In the treatment of his aneurysmal cases, the author employed concussion exclusively as a crucial test. Having established its specificity, he no longer eschews those adjuvant measures which combat aortectasis, viz., inhibition of cough by codein, the use of laxatives, anti-luetic treatment and a plenitude of physical and mental rest. The influence of the latter on aortic tonicity has been shown on page 466. One must also remember that an hypodermatic injection of pilocarpin (.0065 gm.), will accentuate the aortic reflex of contraction (page 457). One may also advise the patient to increase vagus-tonicity by forcible extension of the head (page 469). Such exercises may be taken twice a day; thirty extensions suffice for each séance.

Fig. 133, represents the primitive apparatus necessary for concussion in the absence of more elaborate apparatus. More can be accomplished with an ordinary tack-hammer than with the *useless apparatus* on the market. In fact, with the hammer only, cures were effected by other physicians.

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*Dr. H. Jaworski, of Paris, France, designates the methods of the author as *vertebral reflexotherapy*. Reflexotherapy is given extended consideration on page 636.

Due regard must be paid to the possible consequences when concussion is executed in the treatment of aneurysms (page 640).

The sinusoidal current may substitute concussion, when the stimulating action of the latter is exhausted (page 400).

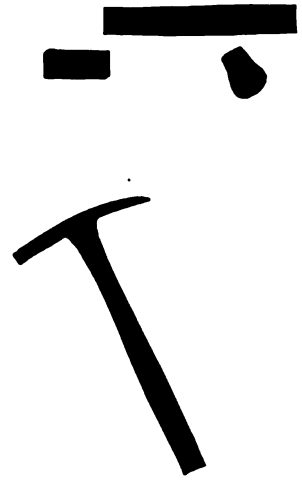

FIG. 133.—Illustrating primitive apparatus for executing concussion. A tack-hammer, over the striking end of which is affixed the rubber-tip of a crutch and a piece of linoleum or other suitable material over the end of which a piece of rubber-tubing is fitted and which is used for pleximetric purposes.

When patients are hypersensitive to electricity, the author employs rubber-cement which is painted on the skin corresponding to the area occupied by the electrodes. The cement must be dry before using the current.

COCAIN KATAPHORESIS.—This is very unsatisfactory, and the negative results suggest a very important field for research. In my investigations, I found that definite cutaneous areas rendered anesthetic by cocain (kataphoretically and by injection) were decidedly more sensitive to electric currents than were normal cutaneous areas. In hysterical subjects, the author has found that

areas of anesthesia peculiar to this disease react similarly.

There is much reason to believe that nerve-energy is a form of electricity and in man there are *electric nerves*. The demonstration of animal electricity galvanometrically is difficult of demonstration, but the foregoing observations may suggest a new field of observation, *i. e.*, by excluding other cutaneous sensations, the perception of electric sensation is demonstrable. After this manner, the law of *specific nerve-energy* (page 545), can be made manifest with reference to problematic electric nerves.

modified and a Roentgenographic examination (individual standing) shows the normal forms of the stomach, according to Holzknecht and Rieder, as pictured in Fig. 134.

In the former, with dorso-ventral transillumination in standing and the stomach filled with bismuth, the pylorus represents the most dependent part of the stomach; a, cephalic pole; b, gas-bladder of the pars cardiaca (fundus); d, pars media (corpus); e, pars pylorica; c, caudal pole (identical with the pylorus). The stomach is the shape of an ox-horn.

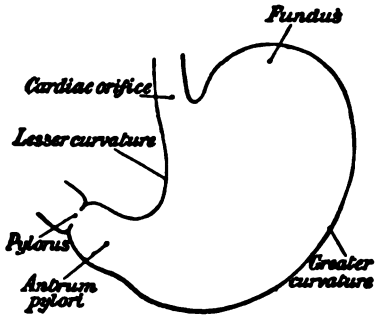

FIG. 135.—Diagrammatic outline of the stomach (Gray).

On page 321, the author has described the vago-visceral method of outlining the stomach and Fig. 86, is only schematic. It is now possible to delimit by percussion practically the entire stomach excepting the *cardiac orifice* (Fig. 135). The latter is situated at a point on the 7th left costal cartilage, one inch (2.5 cm.) from the sternum and corresponds approximately with the body of the 11th dorsal vertebra. Delimitation of the stomach by the author's method of percussion is only possible with *the patient standing.*

During the time the gastric walls are made tense by pressure in an intercostal space by an assistant (which causes reflex stimulation of the vagus), or without an assis-

tant, by having the patient fix his head in forcible hyperextension, as shown in Fig. 65, the stomach yields a dull tone on percussion. The intercostal method may be used in children. The latter dulness at once becomes tympanitic when either of the two foregoing maneuvers are inhibited.

During either maneuver, the dulness of the stomach is differentiated from the resonance of the lung and the tympanicity of the intestines.

Fig. 136 represents a normal stomach outlined by the vago-visceral method of percussion; the continuous line represents the stomach when empty, and the broken lines the position after the ingestion of bismuth; L, represents the lower border of the liver. If a comparison is made between the X-ray pictures of the stomach (Fig. 134) and those obtained by the vago-visceral method of percussion, one notes a discrepancy in size and shape of the organ.

Now, the X-ray pictures have been determined by filling the stomach with a bismuth-paste. We note in Fig. 136, what ensues respecting the form and position of the organ before and after the ingestion of bismuth, and we are constrained to conclude, that the X-ray pictures are *artificial** and only partially reproduce the real shape of the organ. The moment food is ingested, and particularly bismuth, the stomach endeavors to evacuate its contents and the exaggerated vertical posture of the organ is manifested. The latter conclusion was only formulated after repeated examinations of at least one hundred cases. In a small minority of instances, notably in severe grades of gastric atony and gastroptosis, the vago-visceral method was by no means easy, owing to atony of the musculature of the stomach.

*Stiller,[101] likewise protests in accepting the radiologist's conception of the shape of the normal stomach, which, he affirms, is only the specific reaction to the ingested bismuth.

The fact that, there is no transition from tympany to dulness by augmentation of vagus-tone, may be utilized in estimating the tone of the muscular component of the stomach.

FIG. 136.—Percussion of the stomach by the vago-visceral method (page 321). The continuous lines represent the empty stomach and the interrupted lines, the contour of the organ after the ingestion of bismuth. **L**, indicates the lower liver-border.

Having delimited the organ by percussion, one may easily demonstrate that, concussion of the 5th dorsal spine

or paravertebral pressure (page 467), will *enlarge the pylorus* (dilatation) and that similar maneuvers limited to the 3d dorsal spine will *contract the pylorus*. In other words, we elicit the pyloric reflexes of dilatation and contraction.*

To the average reader, these observations seem incredible, but they have been most carefully controlled by X-ray examinations and in other ways.

The following simple test may be utilized in determining the patency of the pylorus; after careful percussion of the upper and lower border of the stomach, the patient ingests nine ounces of water and the time is noted when the organ passes from the vertical to its normal position. As a rule, this occurs in about one minute.

Paravertebral pressure between the third and fourth dorsal spines, which inhibits vagus-tone (page 472), will maintain the vertical posture of the stomach as long as pressure is continued.

DIAGNOSTIC DATA.—Some reference to this subject is made on page 323.

In several instances, the writer has made an early diagnosis of a *carcinoma of the stomach* by noting irregularities of the borders of the organ after percussion of the latter. *Gastrectasis* caused by pyloric obstruction may be determined by noting the absence of the pyloric reflexes. That is to say, percussion by the vago-visceral method shows neither an augmented area of the pylorus after concussion or pressure at the fifth dorsal spine nor a diminished area, after like maneuvers at the third dorsal spine.

*My measurements show that the location of the *pylorus* in the norm is 8.6 cm. from the lower border of the costal arch in the parasternal line. It has a normal width by percussion of 1.6 cm., and descends 2 cm. after a deep inspiration or after the ingestion of 9 ounces of water. The dilator nerve of the cardia is a closing nerve for the pylorus. Opening of the cardia and pyloric contraction occur simultaneously.

Perigastric adhesions may be surmised when percussion of the stomach shows no descent of the latter during forced inspiration.

An hour-glass stomach was determined in one patient.

Spasm of the pylorus may be differentiated from hypertrophic stenosis by elicitation of the pyloric reflexes.

CARDIOSPASM (contraction of the cardiac orifice) is usually associated with esophageal dilatation. Regurgitation of food may or may not be present. The food regurgitated is not from the stomach. Radiographs show the dilatation and esophagoscopic examination demonstrates the presence or absence of pathologic conditions. In cardiospasm of neurosal origin, pressure between the third and fourth dorsal spines by inhibiting vagus-tone (page 467), will enable the patient to swallow without difficulty during maintenance of pressure.

In cardiospasm, the stomach tube (30 to 35 French scale), is arrested at a point about 8 or 10 inches from the teeth. In any obstruction of organic origin small sounds or tubes will pass a stenotic orifice more easily than large ones. The contrary holds when a spasm is functional. The etiology of cardiospasm is obscure. A few cases are associated with gross lesions (ulcers, fissures) of the esophagus or stomach (carcinoma) and neurasthenia as a factor in etiology is no doubt exaggerated.

If, during the passage of a tube, the latter is obstructed owing to a spasm of the esophagus, paravertebral pressure between the 3rd and 4th dorsal spines, by releasing the spasm, permits of the introduction of the tube.

Gastroptosis may be differentiated from dilatation of the organ by noting the position of the lesser curvature of the organ in relation to the greater curvature. In gastroptosis, the pylorus and lesser curvature are correspondingly de-

pressed, whereas in gastrectasis, it is the greater curvature which is displaced downward. By the author's method of percussion, the normal distance between the two curvatures is approximately 5 to 8 cm.

Gall-bladder disease (cholelithiasis and cholecystitis), causes adhesions and definite displacement of the stomach and duodenum. The evidence of such adhesions has been demonstrated fluoroscopically in the upright position. Pfahler[102] directs attention to the fact, that the symptoms of gall-bladder disease appear during digestion when adhesions interfere with the emptying of the gall-bladder, either directly or because the gall-duct has been drawn abnormally high.

Vago-visceral percussion of the stomach may be equally utilized in diagnosis by noting the approximation of the pyloric end of the stomach to the gall-bladder. It is also true that adhesions would prevent the vertical posture of the stomach after the ingestion of water or food.

Pharmaco-diagnostic data with relation to the stomach have been noted on page 453, and it is well to bear in mind the centers in the cord sensorially related to the stomach (page 377). If the third, fourth and fifth dorsal spines are thoroughly frozen, all subjective and objective sensations of gastric genesis evanesce from minutes to hours. Thus, one may differentiate gastric from other affections. Supplementary to the data on page 453, my observations show that, adrenalin dilates and pilocarpin contracts the stomach. Thus, 10 minutes after an injection of pilocarpin (gr. $\frac{1}{10}$), the vertical diameter of the stomach (lesser to greater curvature) measured 2 cm., although before, it measured 5 cm. Ten minutes after an injection of 8 minims of adrenalin chlorid solution (1:1000), the same diameter of a stomach increased from 5.6 cm. to 9 cm. After this manner one may

determine whether gastric neuroses are under sympathetic or autonomic control.

The *treatment of gastric affections* has been discussed on page 324. Supplementary to treatment referred to on the latter page, a comparison of concussion and slow sinusoidalization is shown by the following results: the duration of concussion and sinusoidalization of the second lumbar spine was one minute.

CONCUSSION.

Degree of stomach reflex of contraction.....2.8 cm.
Duration of stomach reflex of contraction....5 minutes.

SLOW SINUSOIDAL CURRENT.

Amplitude of stomach reflex of contraction.....2 cm.
Duration of stomach reflex of contraction....11 minutes
While the amplitude of the reflex was less with the current, its duration lasted more than twice the time.

PERCUSSION OF THE INTESTINES.

Physiologists are divided concerning intestinal innervation. The viscero-motor nerves are derived from the vagi and sympathetic chain.

Clinical physiology, however, sheds some light on the subject. The different maneuvers for increasing vagus-tone (page 469) do not influence the intestinal reflexes (pages 325, 326), but the latter cannot be elicited if the vagus-tone is removed by pressure between the third and fourth dorsal spines (page 467).

In this regard, the action of the vagus may be compared to the brain and cord. Irritation of the latter has no evident effect on intestinal movements during life, yet one knows that the mentality may influence the movements and that in paraplegia, intestinal motility is diminished and tympanites ensues.

The elicitation of the intestinal reflex of contraction (page 325), causes a contraction of all the intestines and it is impossible to differentiate individual portions.

It is now possible, however, to elicit dulness of definite intestinal areas by aid of paravertebral pressure with the radicularpressor (Fig. 112). Pressure must be maintained by an assistant during the time percussion is executed and the patient must be *standing*. In some instances the area of the intestine yields an absolute dulness, and in other instances it is only tympanitically dull.

The following pressure sites have been established:

1. DUODENUM.—Pressure on both sides of the *10th dorsal spine*. The dulness thus elicited averages in width 4.5 cm., and extends an average distance of 5.5 cm. from the pyloric end of the stomach. Unlike the stomach, it is uninfluenced by the movements of respiration, and the site of the dulness does not change like the stomach by concussion of the 11th dorsal or 2nd lumbar spines.

2. SIGMOID FLEXURE.—Pressure on both sides of the *1st dorsal spine*.

3. CECUM WITH ATTACHED ILEUM? AND ASCENDING COLON.—Pressure on both sides of the *12th dorsal spine*. Careful percussion demonstrates an area of dulness attached to the cecum averaging 2.5 cm. in width and 3 cm. in length. This is possibly a part of the ileum.

4. DESCENDING COLON.—Pressure on both sides of the *1st lumbar spine*. The average area of dulness is small (6 cm. x 6 cm.) and is located above the dulness of the sigmoid flexure in the left lumbar region.

5. TRANSVERSE COLON.—Pressure on both sides of the *4th lumbar spine* The area of dulness extends across the umbilical region from the ascending to the descending colon.

Its limitation at its upper part is not always clearly defined. The width of the dulness averages 4 cm.

FIG. 137.—Areas of intestinal dullness elicited by paravertebral pressure. The dullness of the stomach (s) was determined by the vago-visceral method (page 321), D, duodenum; C, cecum; I?, probably attached ileum; DC, descending colon; SF. sigmoid flexure; TC, transverse colon, the continuity of which is interrupted in the illustration by the stomach and duodenum. Compare with Fig. 138.

Fig. 137, shows the location of the areas of intestinal dulness elicited by paravertebral pressure at definite spinous processes and Fig. 138, shows the normal topography of the intestines.

D i a g n o s i s

Recently,[103] attention has been devoted to a *mobile cecum* (coecum mobile), which produces symptoms resembling appendicitis and at the operating table the appendix was normal. The value of topographic percussion in such instances is apparent without comment.

I wish to illustrate some of the foregoing methods by the citation of a case seen with Dr. A. Gates, of Los Angeles.

> The patient has lost 20 pounds in weight during the past year. Has recurrent attacks of pain for years in the epigastrium of a dragging, piercing character, several hours after food is taken, which is relieved by the ingestion of more food or sodium bicarbonate. The history suggests a *duodenal ulcer.*
>
> Percussion made during the time the head was extended (Fig. 65) demonstrated a dilated stomach. Pressure at the 10th dorsal spine elicited the dulness of the duodenum. During forced inspiration, the area of gastric dulness descends showing that there are no perigastric adhesions. When the patient ingested 9 ounces of water (page 588), the stomach remained in the *vertical position* for 10 minutes (1 minute in the norm). It was then assumed that there was a pyloric obstruction. The latter, however, was a *spasm of the pylorus*, for when pressure was made between the 3rd and 4th dorsal spines (which releases gastric spasms, page 589), the stomach at once assumed its normal position. The dilatation of the stomach it was assumed was likewise caused by the spasm and not a mechanic obstruction. Further confirmation of the pyloric spasm was elicited by the fact that pressure at the 5th dorsal spine (page 588) caused an increase in the percussional area of the pylorus.
>
> Over the area of gastric dulness, a very tender spot (1 cm. in width) was palpated which shifted upward after concussion of the 2nd lumbar spine and downward by concussion of the 11th dorsal spine and a forced inspiration. A tender spot of like area was located at the duo-

denum but which showed no dislocation on inspiration nor concussion.

Freezing the 3d, 4th and 5th dorsal spines (page 377), caused the area of gastric tenderness to disappear but did not influence the duodenal point of sensitiveness.

Diagnosis.—Ulcer of the stomach and duodenum.

COMMENT.—The presence of occult blood in the feces is a valuable diagnostic point.

Exclusive *rectal feeding* (not even water by the mouth) causes the symptoms of gastric and duodenal ulcer to disappear in a few days and is equally diagnostic.

Duodenal ulcers are frequently confused with gastric ulcer. The former occur usually in early adult life and are characterized by periodic attacks of "stomach trouble." Pain and tenderness usually extend from the mid-line to the right and the accentuation of symptoms due to ingested food occurs several hours after a meal. The so-called "hunger-pain" is a frequent symptom.

Auscultation of sounds evoked by intestinal peristalsis shows that, the sounds are increased in intensity during the time pressure is made between the 3d and 4th dorsal spines and that they become less loud or are inhibited during the time pressure is maintained at the 7th cervical spine.

THE LIVER.

The study of visceral anatomy or organology in the conventional way in the dissecting room, gives us an inadequate conception of the topographic anatomy of the living viscera. This criticism is equally applicable in the arraignment of the conventional methods of percussion. The lower border of the liver may be cited as a paradigm. Percussed in the usual way and compared with the author's methods on page 598, it will be found that, it is usually 4 cm. lower than would be indicated by percussion after the accepted methods

(Fig. 139). Reference to the foregoing observation must be recalled in locating the site of the gall-bladder.

By what the author designates as *splanchnoscopy*, the observation in question is likewise confirmed.

The ascent and descent of the lower border of the liver may be observed when the patient is placed with flexed knees on a table with the head against a good light. The observer stands with his back likewise to the light and fixes his vision on the epigastrium. The patient must execute forced breathing. The shadow may be traced to both sides of the median line of the epigastrium. In women, owing to the thoracic type of breathing the shadow, is less evident.

The shadow may be accentuated, as the author has shown in his investigations[104] of the phrenic shadow, by painting the skin (embraced by the shadow) with a saturated alcoholic solution of gamboge.

THE GALL-BLADDER.

The fundus of the gall-bladder projects beyond the anterior border of the organ.

A line drawn from the right acromion process to the umbilicus crosses the costal arch approximating the location of the gall-bladder. The latter in its long diameter measures from 7 to 10 cm., and about 4 cm., in its greatest transverse diameter.

The site of the gall-bladder varies with the position of the lower border of the liver and the latter is practically always lower than the description in the conventional textbook (page 596).

The reason for the latter error is obvious. The lower liver-border is immersed in an atmosphere of tympanitic sound and its edge does not exceed one centimeter in thickness.

The usual methods of percussion are untrustworthy in defining the topography of the organ.

Two methods are available for mapping out the lower liver-border:

FIG. 139.—Method of locating the gall-bladder by the postural method. The dotted line represents the lower border of the liver obtained by percussion in the usual way. The heavy line represents the lower border obtained by the postural method. It is only in this way that one can account for the different results obtained by clinicians in locating the lower border of the liver which is really lower than is currently supposed.

1. *Postural method.*—During percussion, the patient inclines the body backward as far as possible, and, to relieve the tedium of the posture, the body is supported by means of the hands resting on the hips or by an assistant. Percussion must be light (Fig. 139).

The rationale of this maneuver, I have described else-

where[105]. In the posture suggested, the liver is approximated to the abdominal parietes.

2. *Vago-visceral method.*—During light percussion, the head is fixed in the position as shown in Fig. 65.

The rationale of this method involves the principle of visceral-tone and is described on page 451.

Having located the lower liver-border by either of the foregoing methods, one seeks to locate the gall-bladder by percussing in the directions shown in Fig. 139.

The *tympanitically-dull* area of the gall-bladder is in marked contrast with the dulness of the liver-border.

In percussing the gall-bladder, the postural or vago-visceral method must be maintained.

Note the following concerning the gall-bladder area of tympanitic-dulness:

1. It descends on inspiration;

2. It is *diminished* or disappears after concussion of the 4th, 5th and 6th dorsal spines;

3. It *enlarges* after concussion of the 9th dorsal spine.

DIAGNOSTIC DATA.—The pear-shaped dulness of the gall-bladder rising and falling in respiratory rhythm with the liver would exclude adhesions.

Pain due to disease of the gall-bladder may be accurately located.

Riedel's lobe (a freely movable linguiform body), which is common in chronic disease of the gall-bladder, may be determined by percussion. It may be on either side of, or over the gall-bladder. According to the *law of Courvoisier*, in cases of chronic jaundice due to obstruction of the common bile-duct, contraction of the gall-bladder signifies that the obstruction is due to a stone; dilatation of the gall-bladder suggests that the obstruction is due to causes other than a stone.

This law is based on the fact that in cholelithiasis, the gall-bladder is the site of chronic inflammation, and is, in consequence, contracted and not capable of dilatation. Hence, if percussion shows an enlarged gall-bladder, cholelithiasis may, as a rule, be excluded, and it is evidence in favor of a neoplasm.

TREATMENT.—In the absence of a stenosis or obstruction in the common duct, concussion of the 4th, 5th and 6th dorsal spines eventuates in evacuation of the contents of the gall-bladder.

The latter maneuver is indicated in catarrhal jaundice, infectious cholecystitis and in the so-called hepatic intermittent fever associated with gall-stones.

> Chronic cholecystitis is usually of infectious origin, and infection is a frequent exciting cause of gall-stone formation. Owing to the anatomic arrangement of the cystic duct (infolding of the mucosa in the form of valves), free drainage of the gall-bladder is difficult and the method suggested in treatment may be executed.

THE PANCREAS.

The author, as a result of his limited investigations, finds that the secretion of the pancreas is probably increased by concussion of the 4th, 5th and 6th dorsal spines.

The investigations were based on the more recent methods of determining the function of the pancreas by testing for the presence of ferments in the stool.

> Rapid peristalsis is hastened after breakfast of mixed food by an enema and calomel (0.2 gm.) and phenolphthalein (0.5).
>
> Activity of the pancreas is determined by the presence in the stool of trypsin and amylopsin. Their absence suggests pancreatic insufficiency or obstruction.
>
> The Wohlgemuth[106] method for amylopsin is probably

the most reliable. One prepares a 1 per cent. solution of Kahlbaum's soluble starch prepared on a water bath for about ten minutes with considerable stirring. In the absence of a fluid stool, 5 gm. of stool is rubbed up with 20 c.c. of a physiologic salt solution and after being centrifuged and filtered varying solutions of this stool-filtrate are added to 5 c.c. of the starch-solution in test-tubes. Dilutions of 1 to 10, 1 to 100 and 1 to 1000 suffice. To the solution of the starch in the test-tubes, toluol is added and the whole digested for 24 hours (38° to 40°C.). At the end of this period, the test-tubes are almost filled with tap-water and one drop of tenth-normal iodin solution is added to each tube. If the starch has been completely digested no blue color appears in the tube.

The estimation is made in units; one unit representing the ability of 1 c.c. of stool-filtrate to transform 1 c.c. of starch. If the tube containing the 1 to 1000 dilution transforms 5 c.c. of starch-solution, then 1 c.c. of undiluted filtrate is capable of digesting 5000 c.c. of starch-solution. This represents a normal finding (5,000 units).

The minimum number of units is 100, although in the tests of Heyn,[107] in non-pancreatic cases, they did not fall below 250 units.

In pancreatic disease, the findings may be 50 units or lower.

CHAPTER XVI.

PHYSIO-THERAPY OF PULMONARY TUBERCULOSIS.

ANEMIC THEORY—CLINICAL EVIDENCE—TRIANGLES OF GROCCO—METHODS FOR ELICITING LUNG-HYPEREMIA—RÉSUMÉ—TREATMENT—AUTHOR'S TREATMENT—VISCERAL VASCULARITY—BLOOD—VOLUME.

ANEMIC THEORY.—According to Rokitansky, one rarely encounters pulmonary tuberculosis in association with mitral insufficiency for the reason that, in the latter disease, there was congestion of the pulmonary vessels. This contention despite its assailment still holds.

FIG. 140.—Semi-diagrammatic representation of the pulmonary air-vesicles (Landois and Stirling). v, v, blood-vessels at the margins of an alveolus; c, c, its blood-capillaries; E, relation of the squamous epithelium of an alveolus to the capillaries in its wall; f, alveolar epithelium shown alone; e, e, elastic tissue of the lung.

Orth, observed that, kyphotics despite their limited respiratory excursions owed their immunity to tuberculosis in consequence of congested lungs.

Clinical Evidence

In pulmonary stenosis, tuberculosis is the usual sequela owing to pulmonary anemia.

It was the belief of Bollinger, that tuberculosis showed a predilection for the apices for the reason that, they were more anemic than other lung-areas owing to gravity.

The influence of posture on the blood contained in the lungs has already been noted on page 290. The vascular supply of an alveolus is shown in Fig. 140.

While the amount of blood in the lungs is influenced by gravity, this static factor is not the only one. A very important factor is the activity of the organ (*ubi irritatio, ibi affluxus*).

Pulmonary suction refers to the large quantity of blood drawn into the lungs with each inspiration, and this physiologic process has not been inaptly compared to a species of dry cupping. Chapman avers, "That if at the termination of expiration the quantity of blood in the lungs is from 1-15 to 1-18 of the total quantity of blood in the body, at the termination of inspiration, it will be from 1-12 to 1-13." The pulmonary vessels expand with each inspiration and contract during expiration, the result being an increased flow of blood from the right heart and lungs; the dilated vessels as Campbell puts it, "actually suck the blood out of the right heart."

As is known, lung-anemia aids caseation of tuberculous nodules. Tuberculous invasion of the pulmonary apices is probably due to impaired circulation; the posture of the body by gravity diminishing the supply of blood to the upper part of the lungs.

CLINICAL EVIDENCE.—One meets with a definite clinical picture antedating pulmonary tuberculosis and which, in reality, may be the disease itself. The lungs are hyperresonant and suggest emphysema, there is no postural lung-

dullness (page 290), the heart is small and enfeebled, systolic murmurs are heard over the pulmonary artery or aorta or both, the triangles of Grocco cannot be elicited, there are zones of atelectasis (page 299) and the signs of pulmonary anemia (page 301).

Tissue vulnerability is recognized in certain diseases like diabetes and we anticipate cutaneous and other complications because sugar is demonstrated in the urine. In pulmonary tuberculosis, however, this tissue-susceptibility is ignored, although the pretuberculous lung is essentially an emphysematous lung, and characterized by hyperresonance, extension of the lung-borders, unchanged percussion note during both phases of respiration and restricted movements of the diaphragm.

One ascribes the percussion sound over the lungs to vibration of the chest-wall and the air within the lung-alveoli, but another factor must not be ignored, viz., the quantity of blood in the lungs.

One may reproduce this lung-picture of the pretuberculous lung by concussion of the seventh cervical spine and develop an antagonistic picture by concussion of the last four dorsal spines.

In the latter maneuver the maximum effect is secured at the *tenth dorsal spine.*

In the first maneuver, we have excited the reflex of the pulmonary artery (page 526) and diminished the quantity of blood in the lungs, whereas in the second maneuver, we have dilated the pulmonary vessels (page 607), and increased the quantity of blood in the lungs.

If one carefully auscultates the pulmonary and aortic sounds at the end of expiration in pulmonary tuberculosis, one will be astounded at the frequency with which ***murmurs*** of a functional nature are encountered.

These murmurs are usually systolic pulmonary and aortic murmurs, the former being more frequent than the latter. No note is taken of subclavian murmurs (page 533), which are relatively frequent in phthisis.

The systolic murmurs, are usually soft and blowing sounds, or merely whiffs and they vary in character and extent of transmission from time to time.

The murmurs in question may be due to anatomic lesions but in the majority of instances, they are functional and due to narrowing of the pulmonary artery and aorta as evidenced by the fact that they disappear temporarily after concussion of the tenth dorsal spine which dilates both vessels.

The coarctation of the vessels is in part spasmodic (page 525), for the reason that the murmurs are heard at one time and are absent at another time.

As a rule, however, the diminished lumina of the vessels is a permanent condition.

Rokitansky noted that too voluminous lungs coupled with a small heart characterized the phthisical habitus. This observation was relegated to oblivion until revived and vigorously defended by Brehmer.

The anemia of early phthisis suggests chlorosis and has therefore been hyphenated as *chloro-anemia.*

In 1872, Virchow, in a monograph, called attention to the fact that a diminution of the aortic lumen, attended frequently by anatomic changes in its walls, was the almost invariable result of an autopsy made on a chlorotic individual.

In some typic instances, the aorta did not exceed a normal femoral artery in caliber. In many instances, the pulmonary artery was similarly involved, the heart was small and its constituent parts proportionately hypoplastic. Another phenomen was the extreme elasticity of the arterial walls.

Pulmonary anemia (page 301), is one of the most impor-

tant symptoms of early phthisis. The hematologist, however, does not concede the existence of anemia in tuberculosis, although practically every clinical symptom negatives the latter observation. It is quite probable that while the blood of the peripheral circulation may show a normal blood count, it is not necessarily so with the blood in the rest of the body.

> The investigations of the author show that the quantity of oxygen in the blood in phthisis is diminished (*anoxemia*) and that the increase of red corpuscles (polycythemia) is purely compensatory for there is always an increase in the number of erythrocytes in the blood when the normal process of oxygenation of the body is impaired (phthisis, valvular diseases, emphysema, chronic bronchitis, asthma).

In the phthisical lung, the *paravertebral triangles* (triangles of Grocco), are diminished in area or are absent. These triangular areas of dullness are found in the norm on either side of the spine (Fig. 141); the vertical side of the triangle corresponds to the spine, the base to the lower border of the lung, while the hypothenuse extends from the apex to the outer and lowest point of the base.

The triangles of Grocco are probably due to passive lung-hyperemia as shown by the arrangement of the blood-vessels in Fig. 142. The triangles are probably absent in phthisis owing to the deficiency of blood in the lungs.

In the norm, one finds an area of dullness or diminished resonance on both sides opposite the 3d, 4th and 5th dorsal spines (Fig. 141). I shall designate this area as the *vascular parallelogram*, because it corresponds to the large pulmonary blood-vessels. It disappears, to be replaced by resonance when the 7th cervical spine is concussed and is accentuated after striking the 10th dorsal spine.

In the norm, one may augment the dull area of the para-

vertebral triangle by concussion of the tenth dorsal spine (which increases the quantity of blood in the lung), or diminish the area, by concussion of the seventh cervical spine (which decreases the blood in the lung). It is also influenced by posture (page 290).

FIG. 141.—Illustrating the site of the vascular parallelogram above and the triangles of Grocco below.

Taking an average patient, one finds that in the norm, if the paravertebral triangle measures 8 cm. at the base, after concussion of the tenth dorsal spine, it may be increased to 15 cm.

One may also note that the triangles increase in area at the end of a forced inspiration (pulmonary suction, page 603) and diminish in area at the end of a forced expiration. An hypodermatic injection of *adrenalin chlorid* (eight minims), will maintain an increased area of triangular dullness for hours. Thus, before an injection, the base of a triangle measured 8.6 cm., whereas after the injection (without previous concussion), it measured 14.5 cm.

The area of the paravertebral dullness may be selected as a guide for the quantity of blood in the lungs, and the author in investigating different maneuvers for augmenting lung-hyperemia, presents the following table. The duration of each maneuver was one minute.

Method	Diameter of Triangle at Base	Duration of Increased Paravertebral Dullness
Concussion at both sides of the 10th dorsal spine.	14.9 cm.	One minute.
Direct concussion of the 10th dorsal spine.	10.5 cm.	One-half minute.
Slow sinusoidal current at both sides of 10th dorsal spine.	16 cm.	Two and one-half minutes.
Rapid sinusoidal current at both sides of 10th dorsal spine.	14 cm.	One minute.
High-frequency current at both sides of 10th dorsal spine.	11.9 cm.	One minute and forty seconds.
Pressure at both sides of 10th dorsal spine.	15 cm.	Three minutes.

Compare the foregoing with the table on page 398. The latter refers to the diffused pulmonary dullness the result of an increased quantity of blood in the lungs.

The *blood-supply* of the lungs is derived from the pulmonary and bronchial arteries (nutriment for the lung-tissues). Six thousand liters of blood pass through the lungs in twenty-four hours.

RÉSUMÉ.—The author believes that, anemia of the lungs is one of the fundamental conditions predisposing to tuberculous infection and that therapeutic maneuvers which promote active or passive hyperemia of the lungs are indicated in pulmonary tuberculosis. His method of treatment to be

described presently is marvelously efficient in early cases of the disease, but in advanced cases, his results in the main were futile. He believes furthermore, that in tuberculosis of the joints, the surgeon will yet evolve a method of paralyzing the vasoconstrictor nerves of a vessel-wall so as to augment the supply of blood to the implicated joint.

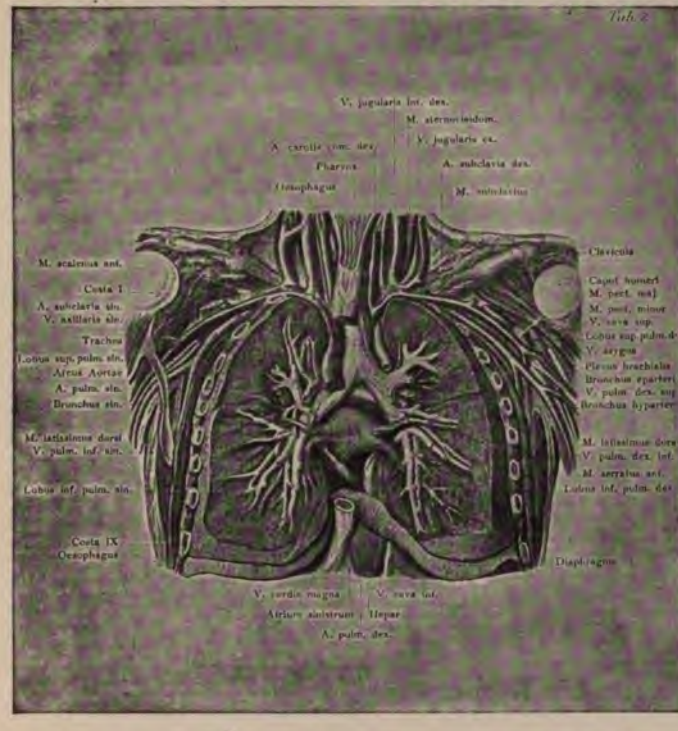

FIG. 142.—Illustrating the arrangement of the pulmonary blood-vessels (Schultze-Stewart, atlas of Topographic Anatomy).

TREATMENT.—Several writers, notably Kuhn and Jacoby, have treated phthisis akin to the lines already suggested. The former uses a mask of light celluloid with an adjustable

valve which shuts off some of the air entering through the mask, which induces a condition of suction-hyperemia (Fig. 143). The mask is used primarily in the morning and afternoon for about fifteen minutes, but later this time is extended to an hour or even more. There are many reports concerning its great value in phthisis.

FIG. 143.—Mask of Kuhn, to produce suction—hyperemia of the lungs.

My investigations show that, the use of the mask elicits a moderate increase in the area of Grocco's triangle.

By the method of Jacoby,[108] hyperemia in the lungs is induced by lowering the upper part of the trunk by a special reclining chair (Fig. 144).

> "*Autotransfusion*," as he calls his method, flushes the apices and does away with the conditions favoring the tuberculous process. With his chair the entire trunk lies horizontally, the head can be slightly raised, while the legs lie higher than the shoulders. By this arrangement, the pelvis is on a line with the chest, not lower than the chest according to the usual method of reclining.

The pelvis can be raised a little higher than the chest by an interposed cushion which supplements the hyperemia induced by the autotransfusion with compression of the base of the lungs by the pressure of the intestines sliding down against the diaphragm. The respiration is more of the costal type, and the lungs are much better ventilated when the trunk is lying flat than when the patient

FIG. 144.—Reclining chair of Jacoby for autotransfusion.

is half sitting up, possibly with the shoulders stooping forward; this actually increases the tendency to anemia of the apices. He raises the feet higher by an inch each three days, until the feet are 18 inches above the level of the head. The patients find that they can breathe more deeply and more easily and that expectoration is promoted. Usually the occasional sharp pains in the chest disappeared during this position treatment. The horizontal attitude is not so agreeable for the patients as sitting up but they soon become accustomed to it and like it, as they come to appreciate the benefit therefrom. The method has been applied in various sanatoria in Germany and the general impression seems to be favorable."

The investigations of Bier show that hyperemia is nature's bactericide which is expressed in inflammation (page 404).

THE AUTHOR'S TREATMENT.—Every possible advantage is taken of the home-treatment of phthisis by the hygienic or open-air method which may be summarized as follows:

1. Out-door life in a pure air for every variety of case, without regard to symptoms, in all weathers and seasons, for whole days, and when possible, all night.

2. Hyperalimentation by means of nutritious food, properly selected and prepared, given at definite and frequent intervals.

3. Moderate exercise stopping short of fatigue and an abundance of mental and physical rest.

4. Judicious medical supervision of every detail of the patient's daily life.

The reclining chair or the bed must be inclined after the manner cited on page 292.

During rest, forced inspirations (which increase the volume of blood in the lungs), must alternate several times a day with séances of rapid breathing as though an effort were made to make inspiration and expiration as short as possible. The latter exercise is similar in action to the mask of Kuhn.

Daily séances of concussion at the office of the physician must be supplemented by paravertebral pressure (page 467) at the home of the patient. To protect the skin from the effects of pressure, a small piece of adhesive plaster should be fixed on either side of the tenth dorsal spine.

Pressure may be made several times a day but should not exceed *one minute* in duration, otherwise the pulmonary artery reflex of dilatation becomes exhausted. The séance of concussion for a like reason should not exceed fifteen minutes and must be interrupted.

If the treatment employed is effective in evoking the pulmonary artery reflex of dilatation, the resonance of the

lung is at once supplanted by dullness on percussion, the triangles of Grocco and the vascular parallelogram likewise show accentuated dullness and an augmented area, and any systolic murmur over the pulmonic ostium disappears.

It is evident to the reader that, the rapid sinusoidal current may substitute concussion and may in fact, be more efficient but as the results attained by the author have been mostly effected by concussion, he employs the latter to the exclusion of other methods.

SUPPLEMENTARY TREATMENT.—A daily hypodermatic injection of adrenalin (page 607) may be employed to aid the vascularity of the lung.

Another efficient aid is daily inunctions of *soft green soap* (sapo viridis), one dram once or twice a day. The acutely enlarged glands in scrofula often disappear very rapidly by such inunctions.

The tracheo-bronchial lymph-glands are practically always enlarged in phthisis (page 79) and many of the symptoms are dependent on such intumescence.

The almost miraculous results with sapo viridis in reducing the enlarged glands in scrofula have suggested to the author its employment in phthisis.

It is difficult to define the rationale of such inunctions. Sapo viridis consists principally of potassium oleate.

It is known that consumption is notably absent amongst laborers in lime kilns and those who drink hard water.

The phenomena of life, according to Loeb, depend upon the presence in the tissues of a number of the various metal proteids, or soaps (Na, Ca, K, and Mg) in definite proportions.

By aid of the *calcimeter*, it has been demonstrated that there are a number of diseases dependent on an excess or diminution of lime salts in the blood. When the

estimation shows an excess of lime, citric acid is employed, and calcium chlorid when the lime is deficient. The *parathyroids* probably control calcium metabolism. Symptoms (muscular twitching, tachypnea, etc.), following parathyroidectomy, may be cured by intravenous injections of a 5% solution of calcium lactate.

VISCERAL VASCULARITY.—That one may influence the vascularity of tissues by stimulation of the seventh cervical spine or the tenth dorsal spine can be easily demonstrated.

During the time that a *rapid sinusoidal current* was applied I have had several competent oculists, notably, Dr. Wm. Hopkins and Dr. Morton Hart, examine the eyes ophthalmoscopically. All noted the immediate anemia of the fundus when the current was applied to both sides of the seventh cervical spine and hyperemia of the fundus, when application was made at the tenth dorsal spine. In this way, one could at will induce hyperemia or anemia. Expectant attention on the part of the observers was excluded by not apprising them of the object of my investigations.

The same precautions were taken in a bronchoscopic examination made for me by Dr. Henry Horn, one of the most competent bronchoscopists in the world. His report is as follows:

"The following is a report on the Bronchoscopic findings in the case of Mr. X., made this morning:

The examination was made in the following way: A few drops of a 3% cocain solution was sprayed on the posterior pharyngeal-wall. An applicator, dipped twice in a 20% sol. of cocain was applied to the interior of the larynx but did not extend below the cords.

EXAMINATION 1.

The region just above the bifurcation was very carefully examined with the 7.5 Brunning's tube. The mucous membrane was very pale and pasty looking.

The small folds between the rings were not injected. Gradually, occupying a time-period roughly estimated at from 3-5 seconds, the folds between the rings gradually became very distinctly injected and one could see a faint rosy blush spreading over the other portions of the mucous membrane. After an interval of a minute the mucous membrane became pale again, the blush distinctly faded and the injection in the small depth between the rings became paler but the injection did not entirely disappear. This phenomenon was repeated, apparently at the will of the operator who carried out some electrical manipulation which I could not follow, several times. One could distinctly tell when the pallor commenced and when the mucous membrane commenced to become more congested.

The same experiment was carried out in the larynx itself. The posterior interarytenoid space was selected because there was a very tiny plexus of veins visible.

Here at a given time the small plexus became distinctly paler, and after a few seconds interval the veins began to fill and the blush extended distinctly downward over the posterior fold.

A patient present at the time who had no idea of the object of the experiment, was told to look down the tube and tell what she saw. She also distinctly saw the plexus grow distinctly pale, or injected at the will of the operator."

Comment by the Author.—Pallor was produced with the *slow* sinusoidal current at the 7th cervical spine and congestion, when the electrodes were applied at the 10th dorsal spine. The laryngeal changes were deserving of special consideration insomuch as the mucosa was already blanched by the cocain.

If one inspects the nasal mucosa, one may observe anemic or hyperemic effects according to the site of the application of the current. Like vascular phenomena are demonstratable in the ear-drum.

Despite the contention of the physiologist that the

pulmonary vessels are unprovided with vasomotor nerves, the clinical investigations of the author suggest the probable incorrectness of the dictum in question.

The fact that anemia or hyperemia may be induced at will by the clinician, suggests many possibilities in the treatment of disease. Thus *insomnia* may be influenced, the oculist may render the eye anemic in ocular inflammations, or he may augment the supply of blood in conditions demanding it. However, the author is not in a position to speak authoritatively on the subject. He merely suggests this therapeutic resource in the treatment of a multitude of conditions and hopes that time and the experience of others may establish its value.

He believes that *hemoptysis* may be controlled by application of the sinusoidal current (the rapid, preferably) to either side of the seventh cervical spine and, in the absence of the current, pressure may be used.

The author may be permitted to observe parenthetically, that *amyl nitrite* is the most efficient and expeditious expedient we possess in hemoptysis.[109] Unless it is efficient after the first administration, subsequent inhalations do no good. The value of the drug for this purpose has been extensively confirmed and Hare, who signalizes this drug as a specific in *uterine hemorrhages*, claims that it may even arrest menstruation. Attention must likewise be directed to the author's treatment of LOCOMOTOR ATAXIA. He started from the conviction that, the lesions peculiar to this disease are primarily resident in the spinal vessels. Thus, the spinal sclerosis in ergotism resembles in distribution the degeneration peculiar to tabes. One also finds sclerosis of the dorsal and lateral columns associated with profound anemia.

Now, arteriosclerotic vessels are not rigid tubes but respond to reflex influences by spasmodic contraction. In tabes, the paroxysmal pains and crises are probably caused by a transient angiospasm (paroxysmal claudication of spinal cord), and the author has frequently re-

lieved these symptoms by inhalations of amyl nitrite. In early tabes, by inhalation of the latter, he has temporarily restored the lost knee-jerk. In tabes, *concussion of the 10th dorsal spine*, which augments the vascularity of the spinal cord, has given me most encouraging results, coupled with concussion of the *lumbar spines*.

The eminent clinician, Dr. H. Jaworski, of Paris, France, author of a work on "locomotor ataxia," reports several remarkable results obtained by this method. In reporting one case, he comments as follows: "Called into consultation by a confrere, I saw the hopeless case of a woman, who was unable to stand for five years. After a séance of ten minutes, she could walk without a cane and now comes daily to my office for further treatment. Other symptoms have improved. This case is a real miracle."

Another curious fact, in connection with the author's treatment of phthisis by *concussion of the 10th dorsal spine*, is the enormous increase in the number of red corpuscles following the maneuver. This increase varies from 100,000 to 600,000 corpuscles per cubic millimeter. At first it was supposed that this artificial polycythemia was due to some effect on the bone-marrow but other investigations demonstrated that pressure, sinusoidal and high-frequency currents to the same region eventuated in like results.

Concussion of the 7th cervical spine, on the contrary, caused an average reduction of 500,000 red corpuscles. Estimations were made immediately after concussion. Whereas concussion of this spine causes an increase in the specific gravity of the blood, concussion of the 10th dorsal spine diminishes the specific gravity.

BLOOD-VOLUME.—The foregoing facts suggest many things in clinical pathology, notably, the causation of edema in nephritis (page 632). Concussion of the spines in question does not cause any appreciable change in the

blood-pressure which is in accord with the physiologic axiom that, when the vessels are overfilled or contain less than the normal quantity, mechanisms are present for maintaining the blood-pressure at its normal height. My investigations suggest that the caliber of the blood-vessels is not constant and that the change in lumen, is practically a *compensatory angiospasm* or *angiectasis* to accommodate respectively a decreased or increased volume of blood. One may easily demonstrate increased volume of the organs after concussion of the 10th dorsal spine, or diminished volume by concussion of the 7th cervical spine.

The observation of the older writers of the "full-blooded" (plethora) condition of the patient, played an important part in hematology, but the observation succumbed to the rigid analysis of modern methods despite the fact that, its confirmation was empirically demonstrated by the relief afforded by blood-letting. Bleeding was so inconsistently practiced by the past generations of physicians that it merited the rebuke of Van Helmont, that "a bloody Moloch presides in the chairs of medicine." Blood-letting is one of the lost therapeutic arts. Formerly we bled too much, but now we do not bleed enough.

CHAPTER XVII.

TREATMENT OF WHOOPING COUGH.

PERTUSSIS—AUTHOR'S CONCEPTION OF PERTUSSIS—AUTHOR'S TREATMENT—RESULTS OF TREATMENT—ANALYSIS OF TREATMENT.

Although it is conceded that pertussis is an infectious and contagious disease, the nature of the infection has not been definitely demonstrated. A bacillus, resembling the bacillus of influenza, has been found, which many believe is the pathogenic organism of pertussis.

The disease, after a period of incubation lasting from seven to ten days, is characterized by a catarrhal and paroxysmal stage. The former stage, after a duration of from seven to ten days, is succeeded by the latter stage, in which the cough becomes more convulsive and is characterized by the distinctive and diagnostic "*whoop*."

Including its complications, pertussis is the most fatal infectious disease in children under the age of five years.

Respecting the conventional treatment of the disease, the therapeutic pessimism of Osler is sententiously expressed as follows: "Six weeks and a good big bottle of paregoric."

The entire duration of an average case of pertussis is from ten to twelve weeks or even longer.

Voelcker,[110] in his contribution embracing a careful study of over 550 cases of pertussis, concludes that, "the treatment of whooping-cough constitutes one of the reproaches to the art of medicine. We have no method by which we can shorten the disease, nor can we do more than pilot the case to recovery, modifying symptoms, guarding against com-

plications, and making our patients as comfortable as we can during an illness which has no rival in its discomforts. A specific for whooping-cough has yet to be found. To all those I have tried (and they are over thirty in number), the handwriting on the wall is literally applicable; "Tekel" ("Thou art weighed in the balances, and art found wanting.")

THE AUTHOR'S CONCEPTION OF PERTUSSIS.—It is an infectious disease in which the infection diminishes vagus-tone (chapter XIII). This reduction in tone specially implicates the vagus-fibers innervating the *aorta*. The latter vessel even in health does not show a constant lumen, in fact, its caliber is modified by physiologic conditions and peripheral irritants may cause it to dilate. When paroxysms of pertussis are precipitated by emotions, sneezing, irritation of the throat, etc., there is a temporary aortectasis. Aortic dilatation follows emotional disturbances owing to an increase of adrenalin secretion (page 466.)

I have made careful examinations of the aortic area before and after irritation of the nose, throat and other regions and noted as a result of such irritation, an invariable increase in the caliber of the aorta.

In an infant of eight months, the distance between the manubrium sterni and the vertebral column is only 2.2 cm., and it is quite evident that the slightest increase in the caliber of the aorta will produce pressure-symptoms on important structures.

Reference to Fig. 122, will show the important structures contiguous to the aorta which are irritated by dilatation of the latter and symptoms develop somewhat analogous to aneurysm. In fact, the cough of the latter is not unlike that observed in some cases of pertussis.

In children as well as in adults, one encounters in per-

tussis, aphonia and dysphonia which we are inclined to attribute to excessive coughing, whereas in reality, they are probably pressure-symptoms. I have noted dysphagia in two adults with pertussis and one knows that the mere act of swallowing may precipitate a paroxysm in children. We have commented on the limited sagittal diameter of the chest in children. The lumen of the trachea is maintained by vagus-tone and we know that, when the latter is diminished, the trachea dilates and still further encroaches on the limited intra-thoracic area. Changes in the lumen of the trachea are more frequent in children than in adults owing to the undeveloped condition of the bronchial tree.* Bronchoscopy shows that, even in the norm, the systolic projection of the left tracheal wall by the adjacent aorta is considerable.

Aside from the characteristic "whoop," or a series of expiratory coughs in the absence of the latter, and a marked leucocytosis (chiefly of the lymphocytes), there are no pathognomonic symptoms of pertussis.

A symptom which I have found to be almost invariably present is either an increase in the *area of aortic dullness* on percussion or the dullness in question is accentuated. This may be found in adults as well as in children. The area of dullness in children is about the size of a dollar and is located over the arch of the aorta at, or on either side of the manubrium sterni. The area of dullness is increased by pressure between the third and fourth dorsal spines (page 472), which reduces vagus-tone and dilates the aorta or, by concussion of the four last dorsal spines or the 10th dorsal spine, which provokes the aortic reflex of dilatation (page 255). The area of dullness is diminished or disappears by increasing vagus-tone (pressure at the seventh cervical spine or concussion of the latter).

*According to Przewoski, tracheal dilatation is the rule in chronic coughs.

ment of the gland is movable: The lower border of thymus dullness being defined (the plexímeter-finger still in place), retract the head to its fullest extent. Thymus-dullness rises upward toward neck, leaving a clear resonance on percussion. Mediastinal glands and other enlarged structures do not show this shifting dullness. Aberrant and accessory thyroids must also be taken into account in the differentiation of retrosternal dullness.

THE AUTHOR'S TREATMENT OF PERTUSSIS.—This, as already suggested, is based on the hypothesis that there is a local vagus-hypotonia involving the fibers innervating the aorta and that, while the disease is not necessarily curtailed, its violence is minimized by subduing the factor (*aortectasis*) to which may be attributed many of the symptoms.

There is little doubt in the mind of the writer that some infections are responsible for a like condition. Thus *diphtheria* is said to be complicated with pertussis (perhaps a pseudo-pertussis). Here, the vagus-hypotonia may not only be responsible for the characteristic cough but also for the heart-symptoms and paralyses peculiar to diphtheria. The suggestion having been made, the author awaits the confirmation of his theory.

The following letter was addressed to a few colleagues:—

> "The following simple method has arrested the paroxysms of whooping-cough in a number of patients in from 3 to 7 days:
>
> "Place a plexímeter upon the spinous process of the 7th cervical vertebra and strike the plexímeter a series of moderate blows with a percussion-hammer. The number of blows is of little moment but the blows must be as strong as the child can tolerate without flinching. Some of the mothers accompany the blows with a nursery rhyme or song to interest the child. In the absence of a plexímeter and percussion-hammer, a strip of linoleum

and a tack-hammer will suffice. To avoid cutaneous irritation, cotton may be interposed between the strip of linoleum and the spine. Each séance during the interparoxysmal period should last 5 minutes thrice daily and the harmless method may be executed by the mother or nurse. The undersigned is desirous of collecting reports on this method of treatment from his colleagues and to test the efficiency of the treatment, it would be well to note the number and severity of the paroxysms before and after treatment in each patient.

"The undersigned will explain the rationale of the method in a contemplated contribution and will appreciate the reports sent to him by his confreres.

"This method has also succeeded in some cases of *laryngismus stridulus*."

Pressure (page 467), or the sinusoidal current to the seventh cervical spine, would prove equally effective but the results noted refer to the use of concussion only.

A number of replies were received from physicians throughout the United States who came to San Francisco to study the methods of spondylotherapy and from others. A few replies will be cited.

DR. GEO. H. BAERT, GRAND RAPIDS, MICH.:

"I have cured by your concussion-method, more than twenty cases of pertussis within two weeks. Last week, a patient, Mrs. S., age 30, consulted me for whooping-cough. She received only four treatments and her paroxysms ceased after the second treatment."

DR. A. L. GATES, LOS ANGELES, CAL.:

"Mrs. X. had approximately 24 paroxysms in twenty-four hours. After three days, paroxysms were reduced to six a day. The disease was not curtailed in duration, perhaps owing to the fact that the rapid improvement noted by the patient caused her to neglect coming to my office."

DR. E. GALLIMORE, SAN JOSE, CAL.:

"Patient, age 71 years. Whooping-cough for 8 days with 10 to 12 paroxysms in the twenty-four hours. After three days, paroxysms reduced to three in twenty-four hours, of a very mild character and patient declares herself as well."

"Patient, age 3 years. Seven to eight paroxysms in twenty-four hours, and very *severe at night.* After treatment for seven days her aunt informs me that the paroxysms are so mild and infrequent that they are not noticed."

"Patient, age 4 years. Five to six paroxysms in twenty-four hours reduced to three attacks in the same time after one week."

"Patient, age 6 years. Before treatment, eleven to fourteen paroxysms in twenty-four hours. Reduced in one week to five mild attacks."

"Age 18 months. Six to eight severe paroxysms in twenty-four hours. After one week, reduced to three milder attacks."

"Age 2 years. Fifteen paroxysms before treatment. After four days, reported to have had only one attack during night."

"Age 3 years. When treatment was commenced, was having six to nine attacks in twenty-four hours. After six days, is practically cured."

Ten other cases are reported by Dr. Gallimore, and the results correspond with those cited.

DR. L. LORE RIGGIN, OAKLAND, CAL.:

"If a drug could be found to produce such a marked change, we would herald it as "The find of the day." Treatment of itself is of great value but I find need at times to give a placebo to satisfy parental minds. The great trouble is to get the parents to persist in the treatment and to make the percussion sufficiently hard. The results are in direct proportion to the care and attention of executing the treatment. It is very gratifying to know that the disease *need not* "run its course." In no

case has there been a single complication and no patient has lost flesh. One very interesting case came under my care after suffering intensely for six weeks; the mother was very much discouraged and willing to do anything. Patient was nine years old, had lost flesh and had a bad bronchitis. This patient returned to school, with weight restored, in less than three weeks."

Some random reports are as follows:

"Attacks every hour during the night. Treatment commenced in third week of disease. After the fourth day no attacks at night."

"Noiseless concussion-hammer (electric) used on a child, age 6 years. Treatment lasted ten minutes. No attacks after the first treatment. Sister of this patient had a continuance of attacks of less severity, even after eight treatments."

"Infant. Attacks partially controlled in two, and completely after five days. In a boy in the same family, no apparent results."

"The results of your treatment are in proportion to the efficiency of its execution. All my cases (14), have progressed splendidly, excepting two, in the family of a physician."

"A child had lost very much in weight in consequence of vomiting following severe attacks. Vomiting no longer occurred when treatment was given just before meals, and the patient rapidly regained weight."

ANALYSIS OF TREATMENT IN PERTUSSIS.—An analysis of the medicinal and non-medicinal therapy of this disease demonstrates two things: An inhibition or an augmentation of vagus-tone. Reference on page 453 has already been made to the influence of drugs on the tone of the vagus.

Belladonna shows its best action when pushed to its full physiologic effects. Here, the results are attained by diminishing vagus-tone (page 472).

Antipyrin, one of the most efficient drugs in subduing the

paroxysms, likewise achieves its action by reducing, but not like the former drug, by annihilating vagus-tone.

Many years ago, *sulphate of quinin*, was regarded as a specific in whooping-cough, used in solution as a spray to the mouth and throat. This method was abandoned. As a matter of fact, the author finds that quinin given to secure and maintain its physiologic action is one of the very best drugs for increasing vagus-tone (page 505).

By the use of *Kilmer's belt*, it is claimed that the vomiting spells in pertussis are reduced from 85 to 95 per cent. A band of linen is used, 4 to 5 inches wide and 3 inches less in length than the circumference of the abdomen of the child at the navel, with two strips of elastic webbing, each two inches wide let in at each side, the whole belt lacing at the back. The belt must be tight and worn night and day.

The results with the belt are no doubt effected by reflex stimulation of the vagus (page 208). We know that pressure upon the abdomen will stimulate the vagus even to inhibition of the heart. Thus, when Hönck,[112] recommends abdominal massage in the treatment of pertussis, claiming cures in less than three weeks, the results are probably attained by reflex stimulation of the vagus.

In conclusion, attendants should learn the following simple method of inhibiting paroxysms of pertussis; press the lower jaw of the patient downward and forward as is often done during the administration of an anesthetic to bring the tongue forward.

CHAPTER XVIII.

MISCELLANEOUS DATA.

FURTHER ADVANCES IN THE UTILIZATION OF THE KIDNEY REFLEXES —PROSTATIC HYPERTROPHY—REFLEXOTHERAPY—SPONDYLOTHERAPY IN THE ETIOLOGY OF DISEASE—SYNOPTIC TABLES OF SPONDYLODIAGNOSIS, SPONDYLOTHERAPY AND PHARMACOLOGY OF THE REFLEXES—SPONDYLO-THERAPEUTIC ARMAMENTARIUM.

FURTHER ADVANCES IN THE UTILIZATION OF THE KIDNEY REFLEXES.

On page 359, reference has been made to the kidney reflexes and it was noted that the kidney reflex of dilatation was elicited by concussion of the 6th to the 8th dorsal spines and the counter reflex of contraction, by concussion of the 12th dorsal spine. Since then, however, the author has found that a more decided contraction of the kidney can be evoked by concussion of the *7th cervical spine*, and a more decided dilatation, by concussion of the 10th dorsal spine.

Without entering into the details of the investigations, it suffices to say that the kidney reflexes in the primary instance (page 359), were caused by contraction and dilatation of the *renal parenchyma*, whereas when the 7th cervical and 10th dorsal spines were concussed, concussion of the former contracted the blood-vessels of the organ and thus diminished the volume of the kidney, whereas concussion of the 10th dorsal spine, dilated the blood-vessels and thus augmented the volume of the organ (*vascular kidney reflexes*).

In discussing the subject of *visceral vascularity* on page

614, *et seq.*, the effects of concussing the 7th cervical spine and 10th dorsal spine were noted.

The effects of concussing the latter spines were investigated in a dual direction; by percussing the outer border of each kidney and by functional tests of renal efficiency. In the average subject, the outer border of the right kidney is approximately distant 9 cm. from the spinous processes and the left kidney, 7 cm. The average degree of contraction of the kidney (estimated from the outer border) after concussion of the 7th cervical spine was 1.6 cm., and the dilatation of the organ (estimated from the outer border), after concussion of the 10th dorsal spine was 2.6 cm. A few blows of the hammer on the appropriate spinous processes suffice to elicit the reflexes which are of short duration.

FUNCTIONAL TESTS.—With the kidney reflexes which contracted and dilated the renal parenchyma (page 359), elimination was delayed. Here, contraction and dilatation of the parenchyma, as with the myocardium (page 543), contracted the renal blood-vessels.

After concussion of the 7th cervical spine, which contracted the renal blood-vessels, elimination was likewise delayed, whereas, after concussion of the 10th dorsal spine, *elimination was hastened* in the norm, as well as among nephropaths.

In several instances, in subjects with parenchymatous nephritis, phloridzin glycosuria, which did not take place after several hours, occurred within the normal period of time after 5 minutes concussion of the 10th dorsal spine.

> Among the simplest and most reliable tests for renal sufficiency is that with *phloridzin;* 15 minims of phloridzin solution (1:200) by subcutaneous injection causes sugar to appear in the urine in a healthy subject in from 15 to 30 minutes and the glycosuria continues from 2 to

4 hours. The most important factor is the total quantity of sugar eliminated, which varies from 1 to 2 grams. Diminished or delayed phloridzin-glycosuria usually indicates a renal disease, and a complete absence of sugar may be regarded as a sign of advanced renal disease.

FIG. 146.—Posterior view of the opened head, neck and trunk. The relation of the kidneys to the surface. Compare with Fig. 11. (Atlas of Topographic Anatomy, Schultze-Stewart.)

Before formulating any conclusions concerning the practical value of concussion of the 10th dorsal spine in the treatment of nephritis, succinct reference must be made to the pathology of the latter disease.

Definite knowledge concerning nephritis began with Bright, in 1827, and this has been supplemented since then by the observations of pathologists and clinicians. More recently, an experimental study of nephritis has been attempted to explain the prominent symptoms of the disease.

Albuminuria is caused by increased permeability of the glomerular tuft and degeneration of the epithelial cells of the tubules, thus permitting the soluble proteids in the blood to appear in the urine.

The *urinary casts* arise either from degenerated epithelium or from albumin excreted through the glomeruli. The paroxysmal appearance of a large number of casts ("cast-showers"), is caused by augmented renal circulation with associated diuresis, After concussion of the 10th dorsal spine, cast-showers were demonstrable, even though casts were absent.

Uremia is most probably caused by the retention of unknown toxic products, which in the norm are excreted by healthy kidneys.

Edema has been ascribed to a variety of factors, notably, an abnormal distribution of fluid in the body (von Koranyi), which the French school attributes to the retention of sodium chlorid (there is a diminished execretion of chlorids in nephritis) in the tissues, and that the latter in consequence require a greater amount of water to maintain the salt in solution. More recently, a non-renal factor—altered permeability of the cutaneous blood-vessels, has been suggested to explain nephritic edema. Here, a problematic renal toxin injures not only the blood-vessels of the kidneys, but all the blood-vessels.

Hypertension and *cardiac hypertrophy*, have been at-

tributed to a destruction of the renal parenchyma and to an internal secretion of the kidney.

In summarizing the results thus far attained by experimental methods, it is safe to conclude that they have given us no clue respecting the etiology, prevention and cure of nephritis.

CONCLUSIONS.—"Reasons drawn from the urine are as brittle as the urinal."

Albuminuria is no more an expression of renal disease than is a murmur an expression of cardiac disease (page 525).

Just as we test the competency of the heart-muscle (page 510) and disregard murmurs in a prognostic direction, so must we disregard albumin and content ourselves with determining whether the kidneys functionate adequately as filters. Albuminuria may occur with or without renal lesions.

Thus, *orthostatic albuminuria* (page 122), is differentiated from albuminuria dependent on renal lesions by the following test: If calcium lactate (usual dose), is given for two days in succession, albumin will disappear if it is orthostatic, but will persist if renal lesions are present. It is here assumed that the orthostatic form is caused by diminished coagulability of the blood, which is increased by calcium.

Concussion of the 10th dorsal spine increases the functional efficiency of the physiologic and pathologic kidney and, by rendering the kidneys hyperemic, one is in possession of a puissant agent (page 404) in contending with renal lesions, notably those in which the blood-supply is implicated.

The quantity of blood in the kidneys may be determined by the vascular reflexes of these organs (page 629). In diagnosis, these reflexes are equally valuable. In certain

nephritides, when the increase in connective tissue is at the expense of the secreting structures, the vascular kidney reflex of dilatation is either absent or diminished in amplitude.

The author's theory of nephritic edema has already been discussed (page 617), and he utilizes concussion of the 10th dorsal spine in the treatment of edema whether of cardiac or renal origin.

Later (page 641), it will be shown that, concussion of the 7th cervical spine may compromise the secretory efficacy of the kidneys.

PROSTATIC HYPERTROPHY.

The prostate has a fibromuscular capsule which sends a median septum inward (surrounding the urethra), dividing the parenchyma of the gland into about forty lobules. The prostatic muscular tissue, is made up of unstriated fibers and the second sphincter (vesical or prostatic sphincter), has striated as well as smooth muscle-fibers.

The etiology of *prostatic hypertrophy* is not definitely known and recalls the observation of Sir Henry Thompson, that the best proof of our ignorance concerning the cause is furnished by the manifold factors which are made responsible for its existence. Some ascribe the hypertrophy to a chronic prostatitis usually due to gonorrheal infection, whereas others deny this relationship.

The *symptomatology* of the disease is essentially limited to the obstruction of the urinary flow caused by the enlarged prostate.

Rectal palpation demonstrates the characteristic ball-like shape of the prostate and absence of the raphe between the lateral lobes.

Urinary symptoms are not always dependent on the size of the gland; a small gland may produce severe symptoms,

whereas an enormously enlarged prostate may be unattended by symptoms.

One must also differentiate between simple hypertrophy and malignancy and recall the observations of Young, viz., that one of four cases of prostatic hypertrophy, malignancy is present.

AUTHOR'S TREATMENT OF PROSTATIC HYPERTROPHY.—It has been established empirically that, the best site for contracting the prostate corresponds to the 12th dorsal spine. The rapid sinusoidal current is used; the interrupting electrode (Fig. 46) is fixed at the 12th dorsal spine and a large electrode in the sacral region. Strong currents must be employed. With the finger palpating the prostate during the action of the current, one may note reduction in the size of the gland.

All hypertrophic prostates do not equally respond and when this occurs, little can be expected from this method.

In the latter case, the stage of active parenchymatous and muscular hyperplasia has been succeeded by an overgrowth of fibrous connective tissue.

Results, if any, are immediate, irrespective of the stage of prostatism.

Treatment should be executed daily until definite results are attained.

> *Chromium sulphate* (4 to 8 grains three times a day after meals), is a useful medicament in prostatic hypertrophy. The value of this drug was first established empirically by Kolipinski,[113] who likewise vaunts it as a specific in exophthalmic goitre and established its value in locomotor ataxia and neurasthenia. Unfortunately, this drug is destined to have only a limited use until its value has been established on a more rational foundation. My limited investigations show that it has a powerful vagotropic action (page 451), notably on the sacral autonomic fibers (Fig. 101).

REFLEXOTHERAPY.

Reference to the employment of reflexes in treatment has already been made on page 392. Jaworski, of Paris, dignifies this method by the neologism, ***reflexotherapy*** and refers specifically to the methods of the author as "vertebral reflexotherapy."

All diseases are manifested by a direct and an indirect symptomatology; the latter embraces the reflex symptoms. There are individuals who are reflexophilic, *i. e.*, they have exaggerated reflexes.

The Laborde method of resuscitation in asphyxia, by rhythmic traction of the tongue, is an excellent example of the employment of a reflex. The investigations of the author show that, such lingual traction provokes a ***heart reflex*** of great amplitude and long duration. Furthermore, it augments the *tone of the vagus* and may be employed to secure the latter effect, in addition to the methods described on page 199.

In making a comparative estimate of the methods employed for eliciting the ***heart reflex*** the following results were obtained:

METHOD	AMPLITUDE OF REFLEX	DURATION OF REFLEX
Stretching neck (Fig. 65)	2.6 cm.	2 min., 10 sec.
Concussion of 7th cervical spine	1.6 cm.	1 min., 35 sec.
Cutaneous irritation of precordial region	1.6 cm.	1 min., 10 sec.
Rhythmic traction of tongue	3.6 *cm.*	4 *min.*, 30 *sec.*

The observations of Fliess (page 463), demonstrated the intimate relation existing between the nasal mucosa (*locus genitalis*) and the uterine reflexes.

Denslow, quoting the observations of Otis, demonstrated

a multitude of reflex symptoms (paraplegia, epilepsy, mental confusion), evoked by irritable lesions of the urethra.

Certain forms of *rhinitis* are associated with hemorrhoids and treatment of the former condition has cured the latter (Jaworski).

Bonnier compares the nasal mucosa to a piano in which one can find reflexogenic keys for the entire organism.

If one has carefully studied chapter XIII, the foregoing statement will not be regarded as an hyperbole insomuch as there are many authentic case-records showing the cure of many symptoms (vertigo, dyspepsia, gastralgia, asthma, etc.) by appropriate treatment directed exclusively to the nasal mucosa. The latter consists essentially of cauterization of a definite reflexogenic point in the mucosa at intervals of 8 or 10 days.

Perhaps the most interesting development of reflexotherapy as employed by Denslow, Jaworski, Romero and others, concerns the treatment of *locomotor ataxia.*

Denslow first directed attention to the intimate relation existing between the urethra and tabes and created in consequence his method of treatment by dilatation.

The latter has been confirmed by a number of enthusiastic observers, notably Jaworski. The latter, while regarding syphilis as a prerequisite of tabes, conceives it only as a predisposing cause, and that some peripheric irritation (notably urethral), causes a primary enfeeblement of the roots of the posterior spinal nerves.

The nature of the urethral lesions has not been definitely established but they correspond to the lesions of herpes zoster. They are identified with the lesions of the nasal mucosa. One frequently finds on examination of the urethra, painful elastic or spasmodic strictures. The latter may also cause a variety of reflex phenomena, notably, neurasthenia

and asthma. It has been shown that any irritation of these strictures will accentuate tabetic symptoms. Treatment of the strictures by a meatatomy and dilatation of the urethra by sounds, does not cure tabes, but merely arrests those symptoms dependent on the urethral source of irritation.*

The *rectum* is likewise a prolific reflexogenic territory. Louis XIV suffered from a fistula, and his reign was said to have been divided into two parts—that before and that after the fistula. Some one has said that the chief function of the consultant was to examine the rectum, insomuch as it is often overlooked in our examinations. "More mistakes are made by want of looking than by want of knowing." I recall a patient entrusted to me by an eminent colleague during his absence in Europe. He said, "The patient has a gastric cancer and all you can do is to relieve her incessant vomiting. For some reason, the rectum was examined and after the removal of an enormous scybalum, recovery was immediate.

Before me as I write, is a résumé of cases treated for *rectal diseases* by my friend Dr. W. T. Baird, of El Paso, and presented as a report to the Surgeon-General.

In 85 per cent of the patients, soliciting treatment for various "*reflexes*," there was no knowledge of any rectal disease and only 15 per cent. of the patients complained of local or regional symptoms. The reflex symptoms embraced practically every viscus and were made up of symptomatic pictures ranging from neurasthenia and constipation to rheumatism and cardiac disease.

The most frequent lesion was *ulceration of the rectum* and treatment of the latter usually resulted in complete recovery.

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*Those desirous of pursuing a further study of this subject should consult: "*Un nouveau traitement du Tabes;*" Jaworski, and "*La reflexotherapie dans le Tabes et dans d'autres Maladies;*" Romero.

Reflexotherapy

The following is an extract* of a communication to the "*Congress of Medicine*," at Lyons, (October 10, 1911), by Dr. H. Jaworski, of the Faculty of Medicine, of Paris:

"When confronted with symptoms or lesions, one is no longer permitted to forget their remote effects (*reflexopathy*).

Without wishing to systematize to extremes, nor to say that all symptoms are reflexes, it is nevertheless certain that the reflexes play a primary *rôle* in the biologic mechanism and that, when properly employed, they conduce to useful reactions (*reflexotherapy*).

Some of the reflexes are very complex and different lesions may provoke identical symptoms (asthma, epilepsy).

From a practical view-point, the following may be regarded as the chief reflexotherapeutic methods:

1. LINGUAL REFLEXOTHERAPY (*Laborde*), consists of rhythmic traction of the tongue to excite respiratory and cardiac action.

2. URETHRAL REFLEXOTHERAPY (*Denslow*), consists of rapid dilatation of the urethra, which may be reflexly utilized in the treatment of tabes. It is the most rapid and efficacious treatment in the latter malady. After a few sèances, the tabetic experiences a strong sensation of warmth in the feet, the deep sensibility reappears, gait is ameliorated and, after a variable period of time, there is a disappearance of the pains and symptom of Romberg.

3. NASAL REFLEXOTHERAPY (*Fliess, Bonnier*), is based on the existence of localized reflexogenic centers in the nose, which after cauterization influence favorably, enteritis, hemorrhoids, constipation, asthma and menstrual affections.

4. VERTEBRAL REFLEXOTHERAPY (*Abrams*), consists of percussion of the seventh cervical spine to provoke reflex contractions of the aorta and other vessels conducing to the cure of aneurysms.

*Literal translation.

One frequently encounters patient
fering from the effects of drugs given
poses, and one is constrained to rec
Vergilius, "And he becomes worse fr
used" (*aegrescitque medendo*). This t
is likewise encountered in the empl
therapy.

It must be evident to the reader th
essentially a treatment in which refle
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cited on page 470, will show when such

A patient with an aneurysm of th
cured of the latter, developed pulmonar

a cardiaopath and in another aneurysmal patient, eventuated in anasarcous symptoms. The treatment employed likewise diminishes the supply of blood to the kidneys and thus compromised the functions of the latter (page 634).

In both instances, the symptoms subsided after concussion of the 10th dorsal spine for reasons already cited on page 617. It is quite probable that, dilatation of the heart and aorta consecutive to concussion of the 10th dorsal spine is essentially a reflex of accommodation (vascular reflex) as cited on page 519, and that dilatation of these structures consecutive to concussion of the 3d and 4th dorsal spines is a true parenchymatous reflex (page 474).

In concluding this subject, attention must again be directed to the failure of a reflex responding to one method of excitation, thus necessitating the employment of another physio- or pharmaco-therapeutic method (page 400).

SYNOPTIC TABLE OF SPONDYLODIAGNOSIS*

METHODS EMPLOYED: 1. *Concussion*, BY AID OF HAMMER AND PLEXIMETER (FIG. 2). SEVERAL BLOWS TO THE SPINOUS PROCESS OR PROCESSES SUFFICE. WHEN SEVERAL SPINOUS PROCESSES ARE MENTIONED, AN *asterisk*, INDICATES THE PROCESS FROM WHICH THE MAXIMUM EFFECT MAY BE OBTAINED AND IT MAY BE USED TO THE EXCLUSION OF THE OTHERS. 2. *Pressure*, BY AID OF THE RADICULARPRESSOR (FIG. 112). PRESSURE MUST BE MAINTAINED DURING THE INVESTIGATION. 3. *Freezing* (172). THE LATTER METHOD IS INDICATED IN THE DIAGNOSIS OF *pseudo-visceral diseases* (CHAPTER VI) AND IN THE DIAGNOSIS OF *visceral diseases* BY SEGMENTAL-ANALGESIA (376). THE *numbers in parentheses*, REFER TO THE PAGES IN SPONDYLOTHERAPY, WHERE THE PARTICULAR REFLEX OR SUBJECT IS DISCUSSED.

C, CERVICAL; D, DORSAL; L, LUMBAR SPINE.

SPINOUS PROCESS OR PROCESSES.	CLINICAL PHYSIOLOGY.	SPONDYLODIAGNOSIS.
1st and 2d C.	*Freezing* inhibits functional irritability of the spinal branch of the *trigeminus* (414).	Mitigates the pains of trigeminal neuralgia.
Between 2d and 3d C.	A. *Pressure* or *freezing*, inhibits irritability of *phrenic nerve* (549). B. Elicits *diaphragm reflex* (550).	A. By inhibiting pleural and pericardial pains and pains caused by a distended capsule of the liver or spleen or implicated gall-ducts, the methods are diagnostic. B. This reflex is absent in diseases of the phrenic nerves leading to spasm or paralysis of diaphragm.
1st to 7th C.	*Freezing* inhibits irritability of the cervico-occipital nerves (192).	*Headaches, pseudo-mastoiditis, pseudo-esophagismus* and other painful affections of the head are often caused by a cervico-occipital neuralgia and the relief afforded by pressure (170) or freezing is diagnostic.
7th C.	A. Contraction of the blood-vessels by stimulation of the chief subsidiary vaso-motor center in the spinal cord. B. Increases vagus-tone (469). Chief stimulants are brief concussion (for A), and pressure (for B).	A. 1. *Dullness* caused by *pulmonary congestion* is dissipated and the same applies to areas of abdominal dullness caused by *intra-abdominal congestion*. 2. Relief of cough—paroxysms in *pertussis* by concussion aids in the differentiation of coughs. 3. *Vaso-dilator neuroses* (including hyperthyroidism and congestion of the eye, ear, nose, lungs, &c., are relieved, whereas the symptoms of vaso-constrictor neuroses are accentuated. 4. Area of an *aneurysmal dullness* is diminished and symptoms correspondingly relieved. 6. *Aneurysmal murmurs* disappear or become less accentuated. *Functional murmurs* caused by a dilated heart, aorta or pulmonary artery disappear temporarily. B. 1. *Eye* and *ear affections* due to vagus-hypotonia (441, 496), temporarily relieved by pressure. 2. *Cardio-tonic angina pectoris* (542) is made worse and the *cardiectatic form* (543) is improved by pressure. 3. *Pulmonary* and *cardiac murmurs*, caused by vagus-hypertonia become accentuated. 4. Differential diagnosis of a *pericardial exudate* and cardiac dilatation (209). 5. Increase of visceral tone of organs supplied by vagus permits of their better definition by percussion (471).

Spinous Process or Processes.	Clinical Physiology.	Spondylodiagnosis—(continued).
1st D.	Increases visceral tone of sigmoid flexure.	Percussion of *sigmoid flexure* (592).
2d to 8th D.	Splanchnic vaso-motor reflex of constriction (434).	Relieves symptoms of *splanchnic neurasthenia* (434) and congestion of splanchnic blood-vessels.
3d D.	Contraction of pylorus and opening of cardia (588).	Accentuates symptoms of *hypertrophic stenosis of the pylorus* and *pyloric spasm.* Relieves spasm of the cardia and its concomitant gastric distention (pneumatosis).
3d to 8th D.	Lung reflex of dilatation (294).	Dissipates dullness caused by *lung-atelectasis* (301).
Between 3d and 4th D.	Diminishes vagus-tone and depresses functions of structures innervated by the vagus (472).	1. Augments symptoms of a *dilated aorta* and *heart*, due to active dilatation of these structures (520). 2. Râles of *Asthma* inhibited. 3. Increases symptoms of *intra-abdominal congestion.* 4. *Pains* of vagal origin relieved. 5. Reduces *hypertension* (brief séance of concussion). 6. Increases symptoms of vagus-hypotonia (asthenopia, amblyopia, nervous deafness).
4th, 5th and 6th D.	A. Contracts gall-bladder. B. Contracts pancreas.	A. Concussion of these vertebrae diminishes an area of dullness due to an enlarged gall-bladder.
5th D.	Dilates pylorus (588).	If *pyloric obstruction* is present and pylorus fails to dilate, it suggests carcinoma of the pyloric region and possibly hypertrophic stenosis and not pylorospasm.
6th, 7th, 8th D.	Elicits parenchymatous kidney reflex of dilatation (629).	Pains of a *distended capsule of the kidney* suggesting backache become accentuated and decrease by concussing 12 D. spine which diminishes volume of organ (361).
9th D.	Distends gall-bladder (599).	Failure of the gall-bladder to dilate suggests a chronic inflammation due to *cholelithiasis. Vide.* law of Courvoisier (599).
9th, 10th,* 11th, 12th, D.	A. Accommodation dilatation of aorta, pulmonary artery and heart. B. Increases blood-volume and red corpuscles. C. Increases blood-volume in viscera. D. Increases visceral tone of duodenum (592).	A. 1. Accentuates aneurysmal symptoms and augments area of *aneurysmal dullness.* 2. *Cardiac* and *functional murmurs* due to cardiospasm and contraction of aorta and pulmonary artery evanesce. 3. Accentuates symptoms of the vasomotor neuroses of dilatation. B. Augments symptoms of *plethora.* C. The degree of increase of the *kidney-volume* suggests the character of the vascular supply (629). D. Percussion of the *duodenum.* Dull area of the latter does not shift downward by concussion of 11th D. spine nor upward by pressure or concussion of 2nd L spine as is the case with the stomach.
11th D.	Dilates stomach, intestines, liver and spleen.	Growths or painful points connected with stomach would be dislocated downward (323).
12th D.	A. Augments tone of *cecum.* B. Contracts *prostate.*	Percussion of A, facilitated. Contractility of B, determinable.
1st L.	Increases tone of *colon.*	Percussion and location of *cecum* determinable (592).
1st, 2d* and 3d L.	Contracts liver, spleen, intestines and stomach.	Growths and painful points of *stomach* dislocated upward and to the left (323).

* This, and succeeding synoptic tables are embraced in one large illustrated chart published by The Philopolis Press, 406 Lincoln Building, San Francisco, Cal.

SYNOPTIC TABLE OF SPONDYLOTHERAPY

METHODS EMPLOYED: 1. *Concussion*, 2 *Sinusoidalization* (RAPID OR SLOW, PAGE 397), 3. *High-frequency current* (539), 4. *Freezing* (172). APPLICATION DIRECT OR PREFERABLY TO BOTH SIDES OF THE SPINOUS PROCESS OR PROCESSES. WHEN SEVERAL SPINOUS PROCESSES ARE MENTIONED, AN *asterisk*, INDICATES THE PROCESS FROM WHICH THE MAXIMUM EFFECT MAY BE SECURED AND IT MAY BE USED TO THE EXCLUSION OF THE OTHERS. IN *freezing*, APPLICATION MUST BE MADE DIRECTLY OVER THE SPINOUS PROCESS CORRESPONDING TO THE SPINAL-SEGMENT (376).

C, CERVICAL; D, DORSAL; L, LUMBAR SPINE.

SPINOUS PROCESS OR PROCESSES.	CLINICAL PHYSIOLOGY.	SPONDYLOTHERAPY.
1st and 2d C.	*Freezing* inhibits functional irritability of the spinal branch of the trigeminus (414) and may reflexly influence the other branches.	*Trigeminal neuralgia* and *cervico-occipital neuralgia*. Sensitive vertebral points implicating the cervico-occipital nerves may be located lower down and likewise demand freezing.
2d C.	Stimulation of chronotropic fibers of vagus (518).	*Arrhythmia*. Pressure with radicularpressor (Fig. 112) may inhibit an attack.
Between 2d and 3d C.	*Freezing* inhibits irritability of phrenic nerve (549).	*Singultus*. Pains of pleura, pericardium, liver, spleen and gall-ducts. Here the root-origin of the nerve may be stimulated (electricity) in paralysis of the diaphragm or its functions inhibited (by pressure and freezing).
4th and 5th C.	Contraction of longitudinal fibers of bronchial musculature to excite lung reflex of contraction.	*Asthma* (313), *Emphysema* (315). When emphysema is caused by vagus-hypotonia (495), stimulation of the region corresponding to the 7th C. is indicated.
7th C.	*Vide*, spondylodiagnostic table.	A. 1. *Aneurysms*. 2. *Vaso-dilator neuroses*. 3. *Pertussis*. 4. *Hyperthyroidism*. 5. *Hemoptysis*. 6. Congestion of eye, ear, nose, lungs and other viscera. B. 1. *Cardiectasis*. 2. *Myocardial insufficiency* 3. *Angina pectoris*, of the cardiectatic form (543). 4. *Diabetes*. 5. *Asthenopia* and *amblyopia* due to decreased tone of the vagus. 6. *Nervous deafness*. 7. Diminished *tone of the viscera* innervated by the vagus (471).

Spinous processes or processes.	Clinical Physiology.	Spondylotherapy—(continued).
2d to 8th D.	Elicits splanchnic reflex of vasoconstriction (434).	*Splanchnic neurasthenia* (434). Relief of intra-abdominal congestion.
Between 3d and 4th D.	Diminishes vagus-tone and abolishes practically all vagal reflexes.	*Cardiotonic angina pectoris* (542), *Hypertension* (461), *Asthma* (495), *Emphysema* (hypertonic form), *Enuresis* (502), nervous affections of the *eye* (amblyopia, asthenopia) and *ear*, when caused by vagus-hypertonia, motor and sensory symptoms caused by vagal-hyperesthesia (neuroses of the esophagus, stomach and intestines).
3d to 8th D.	Lung reflex of dilatation (294).	*Pulmonary atelectasis* and to maintain the "open lung" in *bronchitis* (notably in children) in whom there is a tendency to develop broncho-pneumonia in atelectatic areas.
4th, 5th, 6th D.	Contraction of gall-bladder.	*Catarrhal jaundice* and in infectious *cholecystitis* (for drainage).
5th D.	Dilatation of pylorus (588).	*Pylorospasm.*
9th, 10th,* 11th, 12th D.	*Vide*, spondylodiagnostic table.	A. 1. *Chlorosis*, by counteracting hypoplasia (605). 2. *Phthisis* (612). 3. Vasoconstrictor neuroses. B. 1. *Anemia* (by increasing number of red blood corpuscles). C. 1. *Bright's disease.* 2. *Locomotor ataxia* (616).
11th D.	Dilates stomach, intestines, liver and spleen.	*Microgastria, Spastic Constipation, Cirrhosis* of the liver.
12th D.	Contraction of prostate.	*Prostatic hypertrophy* (635).
1st, 2d,* 3d L.	Contraction of 1, stomach, 2, intestines, 3, liver, 4, spleen, and 5, uterus (visceral reflexes of contraction).	1. *Gastrectasis* and *dyspepsia* due motor insufficiency of the stomach; 2. Atonic *Constipation* (328); 3. *Hepatic congestion*; 4. *Splenomegaly*; 5. *Subinvolution* of the uterus, uterine *pseudo-fibromata* (419), *hemorrhage* from the uterus and abnormal positions of the uterus caused by relaxed ligaments (420).
5th L.	Bladder reflex of contraction (358).	Atonic conditions of the bladder caused by insufficiency of the musculature of the bladder.

SYNOPTIC TABLE OF PHARMACOLOGY OF THE REFLEXES*

THIS TABLE IS PRINCIPALLY CONCERNED WITH THE REFLEXES CREATED BY IRRITABILITY OF THE VAGAL AND SYMPATHETIC FIBERS. IN THE NORM, THE LATTER ARE IN PHYSIOLOGIC ANTAGONISM. SYMPTOMS OR DISEASES DUE TO INCREASED VAGUS-TONE ARE ACCENTUATED BY *pilocarpin* AND AMELIORATED BY *adrenalin* AND *atropin*. SYMPTOMS OR DISEASES CAUSED BY AUGMENTED SYMPATHETIC TONE ARE ACCENTUATED BY *adrenalin* AND AMELIORATED BY *pilocarpin*.

Thyroid preparations DIMINISH VAGUS-TONE.

Increased vagus-tone MAY BE DEMONSTRATED BY THE METHODS CITED ON PAGE 470.

Diminished vagus-tone (472), IS CLOSELY RELATED TO SYMPATHETIC IRRITATION. BY THE FOLLOWING TEST, ONE MAY DEMONSTRATE ABNORMAL IRRITABILITY OF THE SYMPATHETIC SYSTEM: IN THE NORM, INSTILLATION OF A DROP OF A ONE PER THOUSAND SOLUTION OF ADRENALIN INTO THE EYE HAS NO EFFECT ON THE DILATOR PUPILLAE (452), BUT IN EXCITABILITY OF THE SYMPATHETIC SYSTEM, PRONOUNCED *mydriasis* ENSUES.

THIS PHARMACO-THERAPEUTIC TABLE SUGGESTS VAGOTROPIC OR SYMPATHICOTROPIC MEDICATION (451).

Pilocarpin, WHICH EXALTS THE VAGAL-REFLEXES IS GIVEN IN DOSES OF $\frac{1}{10}$ GRAIN HYPODERMATICALLY, *Adrenalin*, WHICH AUGMENTS THE SYMPATHETIC REFLEXES AND DIMINISHES THE VAGAL-REFLEXES, IS ADMINISTERED SIMILARLY (8 MINIMS OF A 1:1000 SOLUTION); *Atropin*, WHICH PARALYZES THE MOTOR ENDINGS OF THE VAGUS, IS GIVEN HYPODERMATICALLY (GR. 1-60).

NUMBERS IN PARENTHESES REFER TO THE PAGES IN SPONDYLOTHERAPY WHERE THE PARTICULAR SUBJECT IS DISCUSSED.

REFLEX.	PHARMACOLOGY OF THE VISCERAL REFLEXES.
Heart (199, 454, 511).	*Atropin* abolishes and *pilocarpin* accentuates it. *Bradycardia* and *arrhythmia* caused by direct or reflex excitation of the vagus are inhibited by atropin. This is likewise true in the vasomotor form of angina pectoris (455). *Strophanthin* by intravenous injection (520) is the most rapid medicament for exciting the cardiac branches of the vagus. In cardiotonic *angina pectoris*, the symptoms are accentuated by *digitalis* and *pilocarpin* but ameliorated by *atropin* which intensifies the symptoms of the cardiectatic form (542). *Cardiodynia* (cardiac pain) in neurotics is inhibited by inhalations of amyl nitrite.
Aorta (254, 581).	Contracted by *pilocarpin* (457), dilated by *adrenalin* (457) and the aortic reflexes are inhibited by atropin.
A. Vasomotor Reflexes (273). B. Splanchnic reflex of vasodilation (427).	A. In *arteriosclerosis*, spasm of the vessels (angiospasm) is not infrequent. Implicating the cerebral vessels, the spasm may cause transient attacks of vertigo, aphasia, monoplegia or hemiplegia. Implicating the splanchnic vessels, there are abdominal pains; of the leg, intermittent lameness (claudication); and the crises of locomotor ataxia are probably due to the same cause (616). Amyl nitrite inhalations inhibit the majority of these reflexes. *Diuretin* (15 grains thrice daily) is practically a specific in *arteriosclerotic abdominal colic*. In *migraine*, caused by vagus-hypertonia the thyroids yield excellent results. B. *Digitalin* or *strophanthin*, is endowed with the property of constricting the splanchnic vessels alone. *Chromium sulphate*, (8 grains after each meal in tablet form), is in the opinion of the author, one of the most efficient agents for constricting the splanchnic vessels and is therefore indicated in *splanchnic neurasthenia* (445, 427).

Reflex.	Pharmacology of the Visceral Reflexes—(continued).
Lung Reflexes (294, 298, 455).	These are mediated by vagal-action. *Atropin* abolishes them, *pilocarpin* exaggerates them and *adrenalin* accentuates only the lung reflex of contraction (456). *Asthma*, is caused by increased vagus-tone (502) and this is also true of spasmodic *bronchostenosis* (311). *Adrenalin* is a specific in asthma and in spasmodic bronchial affections (314). Nasal sprays (310) which relieve paroxysms act by eliciting the lung reflex of contraction. *Emphysema* caused by vagus-hypertonia (495) is made worse by *pilocarpin*, whereas the atonic form of the affection is ameliorated.
Stomach Reflexes (316, 453).	*Pilocarpin* accentuates and *atropin* abolishes the stomach reflexes. The motor neuroses of the organ (crises, spasms, &c.), yield to an adequate dose of atropin, whereas *pilocarpin* accentuates the symptoms. *Adrenalin* (590), by dilating the stomach accentuates the symptoms of sympathetic irritation and ameliorates symptoms caused by vagus-hyperesthesia.
Intestinal Reflexes (325, 496).	*Atropin* inhibits and *pilocarpin* intensifies intestinal peristalsis. Many affections of the intestines are identified either with an increased or diminished tone of the vagus (496).
Ocular Reflexes (440,496).	*Eye-strain*, is equivalent to vagus-stimulation (497). Symptoms arising from eye-strain evanesce when the eyes are cocainized (5 per cent. solution). *Homatropin* and *atropin*, do not annihilate all the ocular reflexes.
Nasal Reflexes (462).	The nose is an important reflex center and must be examined as a routine measure in determining the etiology of many diseases of vagal-origin. *Cocain* aids in the diagnosis of *emphysema* (297), *asthma* (462), *dysmenorrhea* (463), *labor* and *gastric pains* (464). Temporary relief of symptoms is achieved by nasal cocainization and perhaps permanent relief by cauterization of susceptible areas of the nasal mucosa (463).

* This subject is most extensively discussed on page 453, *et seq.*

SPONDYLOTHERAPEUTIC ARMAMENTARIUM*

This hammer for evoking the vertebral reflexes (page 7), is called after the French neurologist, plexor of Déjérine. Although employed chiefly for diagnostic purposes, it may substitute a concussion-apparatus in spondylotherapy. Indeed, many physicians have used the plexor exclusively to attain their therapeutic results. The rubber affixed to the plexor is chiefly designed to give resiliency to the blow, an important desideratum in the elicitation of the reflexes.

This pleximeter of metal, covered at one end with rubber, is employed concurrently with the plexor as shown in Fig. 2.

*The illustrated spondylotherapeutic apparatus is purchasable from The Philopolis Press, 406 Lincoln Building, San Francisco.

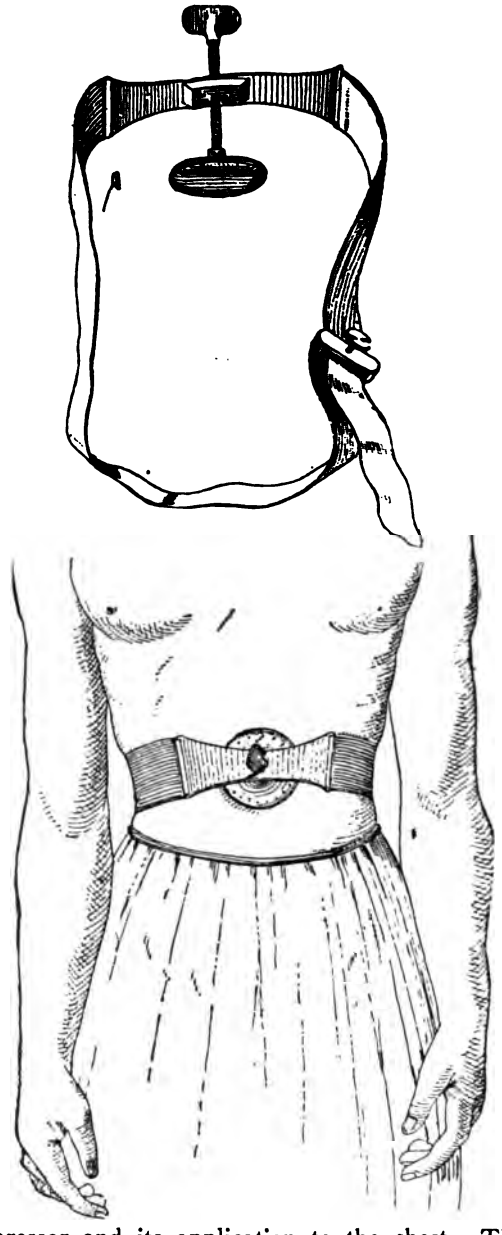
Spondylotherapeutic Armamentarium

The instrument with a single prong (*Algesispondyloscope*), is used for demonstrating areas of paravertebral tenderness (page 66).

The instrument with two prongs (*radicularpressor*), is employed for making bilateral pressure on the roots of the spinal nerves at their exit from the intervertebral foramina.

The employment of pressure in treatment (which I shall neologize as *barotherapy*) has been discussed on page 169, and reference to its diagnostic value (*diagnostic*-barotherapy) has been made on page 467, *et seq.*

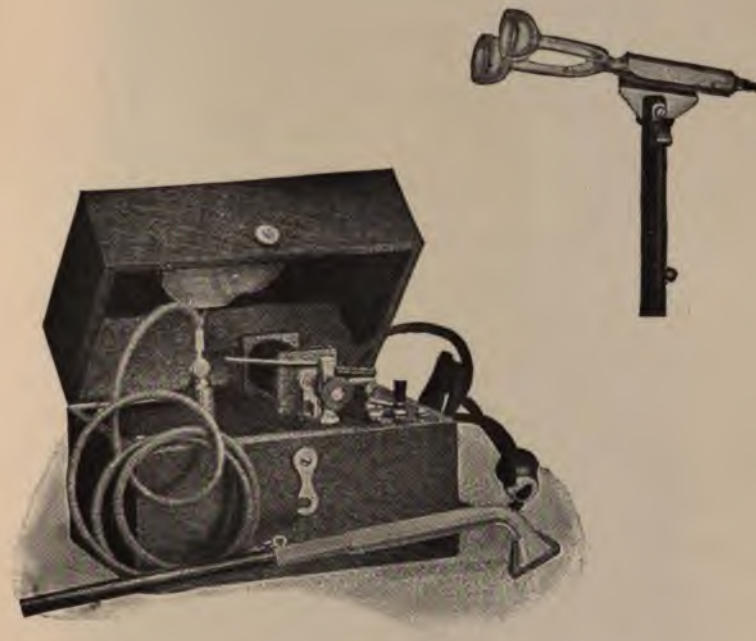
The investigations of the author with barotherapy show that, the efficacy of the treatment is due to blocking of the roots of the spinal nerves.



Vibrosuppressor and its application to the chest. The value of vibrosuppression in diagnosis is discussed on page 80. The cushion of this instrument is provided with a small metallic button so that it may also be employed in barotherapy. By removing the button, the apparatus is used solely as a vibrosuppressor.

Pneumatic hammer with concussors. This operates with a pressure of 40 pounds and yields a blow equivalent to 12 pounds.

This hammer is very efficient but because it is noisy and compressed air is not always available, the electro-concussor of the author is preferable



High-frequency coil and double vacuum electrode. This coil delivers a high voltage and is equally suitable for fulguration and ozone treatment. The coil can be instantly connected with any lamp socket furnishing 100–120 volts either direct or alternating current.

This is a complete sinusoidal and galvanic apparatus. A diagnostic lamp-current may also be obtained. The selection of current is simplified by means of the dial selector and any one of the ten modalities may be instantly selected. The apparatus is constructed to be operated with the 110 volt direct current; but when an alternating current only is available, a rectifier is used to change the alternating into a direct current.

This is a simplified form of the preceding apparatus and delivers a true sinusoidal current. Operated with the direct current, this apparatus gives a galvanic, slow sinusoidal and surging galvanic current. Operated with 110-volt alternating current, it yields a fast and slow sinusoidal current, surging wave and alternating current.

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